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ROYAL BOTANIC GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 1] [1920

I.—THE INDIAN SPECIES OF MIMOSA.

J. S. Gamble.

In the 'Flora of British India' only three species of Mimosa are recognized (vol. ii. p. 291). The First of these is the introduced *M. pudica*, Linn.,* the 'Sensitive Plant,' now so well established in the hotter and damper regions of India that it has become a very troublesome weed, most difficult to eradicate. One noticeable point about it is that while it has been admitted to a place in several Floras, it is only in Dr. Cooke's 'Flora of Bombay' that the curious stiff pectinate bracteoles are mentioned.

1. *Mimosa pudica.*

The Second species is *M. rubicaulis*, Lamk., which is given as found throughout practically the whole of India under a level of 5000 ft., and in which are included *M. octandra*, Roxb., *M. mutabilis*, Roxb., and *M. Rottleri*, Spreng., as well as the undescribed *M. spinosisiliqua*, Rottler. I have been permitted to examine carefully the whole of the collections in the Herbaria of Kew, Edinburgh, Calcutta and Madras, and I have come to the conclusion that they contain at least four different species, as I propose to show.

M. rubicaulis, the 'Acacie à tiges de ronce,' was described by Lamarck (Encyc. Meth. Bot. i. 20) in 1783 from specimens received by him from M. Sonnerat, very likely from Pondicherry or its neighbourhood. I have not seen the specimens, but M. Gagnepain

* The sketches which accompany this give what I consider to be the average form of the leaflets of the 7 species. They have been taken from the middle of the pinna because the uppermost and lowest ones usually differ a little from the middle ones which give the average. They have also been selected so as to show, as nearly as possible, the average shape.

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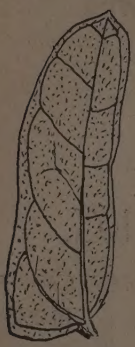
of the 'Museum d'Histoire Naturelle' in Paris tells me that there are two sheets of it in their Herbarium, one of them bearing Lamarck's autograph, and that the leaves and pod agree with those of Indian specimens I sent him for comparison, a comparison which he most kindly made. The description says that the leaves have five pairs of pinnae and 12–15 pairs of leaflets, which are large for the genus. The specimens which belong to true *rubicaulis* are easily separated and among them are those from which Wight prepared the excellent figure published in Hooker's Icones t. 156. The plant occurs only in South India and I have seen no specimens from north of the Godavari. It is represented in the Wallich Collection by nos. 5289 C (Herb. Russell) and D. (Herb. Wight) and the specimens in the Edinburgh Herbarium show that it is the *Mimosa Intsia* described by Roxburgh in Fl. Ind. ii. 565. Mr. W. G. Craib, in his paper on the climbing Acacias entitled 'Mimosa caesia and M. Intsia' (*Kew Bull.* 1915, p. 407) showed that *Mimosa Intsia*, Linn. Sp. Pl. 522 instead of being a climbing Acacia as commonly supposed, is, partly at any rate, *Mimosa rubicaulis*, Lamk. The confusion described so fully by Mr. Craib seems to exclude the possibility of taking *M. Intsia*, Linn. as the earliest name for the plant.



2. *M. rubicaulis.*

There is now the question of *M. octandra*, Roxb. Cor. Pl. t. 200 and Fl. Ind. ii. 564. Both Roxburgh's figure and descriptions seem to me to represent *M. rubicaulis*, Lamk., but Roxburgh's own specimens, named in his own handwriting, in the Kew Herbarium and Wallich Collection do not agree. They have 8–10 pinnae instead of 3–6, 14 pairs of leaflets instead of 8, and the leaflets are quite small. No locality for the specimens is given on the labels so that possibly they may have come from plants grown in the Calcutta Botanic Gardens. I cannot assume that they come from South India.

Of *M. mutabilis*, Roxb. Fl. Ind. ii. 564 with only four pinnae, there seems to be no specimen preserved. It was collected 'on the banks of the Ganges near Benares,' and this may have been the northern limit of *M. rubicaulis*.

Mimosa Rottleri, Spreng. Syst. ii. 206 appears to be merely a new name invented to associate Rottler with the plant which he called *M. spinosisiliqua*, admitted to agree with *M. rubicaulis*, Lam., by Sprengel. The description fits *M. rubicaulis* well enough.

Thus I conclude that the common species of the Southern part of the Madras Presidency is *Mimosa rubicaulis*, Lamk., including *M. octandra* of the 'Coromandel Plants.'

It now remains to identify the North Indian species of which a fine series exists in the Herbaria I have examined. The specimens come from the whole range of the Himalaya, from Afghanistan on the West to the Mishmi hills on the East, and extend to the Assam Valley, the Khasia Hills and Silhet. Southwards, it seems to come down to the Ganges, and further

South, but is apparently scarce. Specimens of my own collected in Hazaribagh and Palamow, and one recently sent by Mr. H. H. Haines from Singbúm show that it extends to the forests of Chota Nagpur. The chief character which distinguishes this plant is that of long leaves with eight to 12 pairs of pinnae each with 16 to 20 pairs of leaflets, most commonly 19. The pod is also narrow and has usually an acuminate apex, though sometimes even the same specimen shows it more or less rounded. The series of specimens shows a good deal of variation in pubescence, for Afghan and Punjab specimens are sometimes almost woolly while the pubescence seems to decrease as it proceeds eastwards. I propose to call it *Mimosa himalayana* as I cannot find that any collector or writer has done otherwise than identify it with *M. rubicaulis*. In the Wallich Collection at Kew there is a specimen with very narrow pod and small pubescent leaflets, collected by Buchanan-Hamilton at Bogdwar in January, 1809. I have quite failed to find Bogdwar on any map, but think it must have been in Bengal, for he spent most of 1809 in Rangpur and Purneah. The plant seems to me distinct from *M. himalayana* and to agree with one collected by Dr. C. A. Barber on the Godavari in the Madras Presidency. I propose to call it *M. Barberi* and to consider Dr. Barber's specimen as the type.

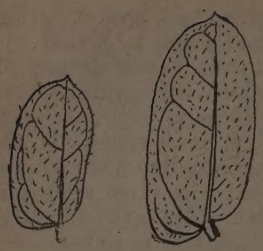
3. *M. himalayana.*

4. *M. Barberi.*

The THIRD species is *M. hamata*, Willd., a very well-marked one, well described by Willdenow to whom specimens had been sent by Klein, and having very small leaflets and a very prickly pod. Rottler called it *M. armata*, unaware, presumably, that it had already been described.

5. *M. hamata.*

Among the specimens which I collected myself in South India in the years 1882 to 1890 were several sheets which puzzled me much, and in 1902 I wrote to Major D. Prain, now Sir David Prain, then in charge of the Calcutta Gardens and Herbarium, about them. He very kindly went into the matter fully, and indicated to me that among the specimens identified as *M. hamata*, Willd., there were a great many which were certainly distinct from that species, which he agreed was the very small-leaved one so well described by Willdenow, and called *M. armata* by Rottler. I now recognize that among them there are two distinct species, (1) that which, in his remarks under *M. hamata*, Mr. Bentham, in Trans. Linn. Soc. xxx. 421, identified with the American *M. polyancistra*, and (2) one which I have described as *M. Prainiana*. As regards *M. polyancistra* I fully agree with Mr. Bentham. I have not seen Pavon's specimens of the American plant, but the Lane (not McLane) specimens from a garden in Cuba are at Kew and agree with the Indian ones except that the calyx and corolla are more hairy. My *M. Prainiana* differs



6. 7.

6. *M. polyancistra.*
7. *M. Prainiana.*

from *M. polyancistra*, as also from *M. hamata*, in several respects, and especially by having pods with 6–8 seeds and more and larger leaflets closely approximate instead of being far apart. I append to this paper the description of this new species as well as those of *M. himalayana* and *M. Barberi* already referred to.

If my views are correct, the number of distinct species of *Mimosa* in India will thus be raised from three to seven including the introduced but universally run-wild *M. pudica*.

The following is a brief Key to the species:—

Pinnae of the leaves 1-2 pairs digitately arranged	1. *pudica.*
Pinnae of the leaves more than 2 pairs, pinnate:—	
Leaves under 1 in. long with 3-5 pinnae; pods grey-puberulous	2. *hamata.*
Leaves much over 1 in. long:—	
Leaflets semi-cordate at base; sutures of pod with strong recurved prickles:—	
Pinnae 3-5 pairs about ·75 in. apart; leaflets 4-5 pairs, distant; pods usually acute at tip, ·6 in. broad	3. *polyancistra.*
Pinnae 5-7 pairs about ·5 in. apart; leaflets 7-8 pairs, touching; pods obtuse at tip, ·4-·5 in. broad	4. *Prainiana.*
Leaflets semi-rectangular at base; sutures of pod with few small or no prickles:—	
Pinnae 4-6 pairs, pinnules 10-15 pairs, ·4-·7 in. long; pods little curved, broad (·6-·7 in.)	5. *rubicaulis.*
Pinnae 6-8 pairs, pinnules 12-18 pairs, ·3-·4 in. long; pods much curved, narrow (·3-·4 in.)	6. *Barberi.*
Pinnae 8-12 pairs, pinnules 16-20 pairs, ·2-·3 in. long; pods little curved, narrow (·4-·5 in.)	7. *himalayana.*

Mimosa himalayana, *Gamble* [Leguminosae-Mimosoideae]; *M. rubicauli*, Lamk., affinis, legumine angustiore acuminato, et foliis longioribus circiter 10–12-jugis nec 4–6-jugis differt.

Frutex erectus, ramis striatis puberulis vel interdum fulvo-pubescentibus aculeis validis ornatis. *Folia* bipinnata, 12–20 cm. longa, rhachi puberula aculeata, juniora pubescentia; pinnae 8–12-jugae, 3–4 cm. longae; foliola 16–20-paria, 5–8 mm. longa, 2–3 mm. lata, oblonga, apice obtusa vel paullo acuta, mucronata, basi semi-rectangularia, hirsuta vel aliquando fulvo-pubescentia, costa margini superiori propinqua, nervis ad costae latus inferius 1–3 arcuatim junctis; stipulae subulatae; stipellae minutae. *Flores* rosei, in capitulis axillaribus ramulorum apices versus pedunculatis, circiter 1 cm. diametro cum staminibus; bracteolae

minutae, clavatae, pubescentes. *Calyx* campanulatus, 1 mm. longus, glaber. *Corolla* infundibularis, 2·5 mm. longa, glabra, lobis 4 oblongis tubo aequilongis. *Stamina* 8, longa, exserta. *Ovarium* glabrum. *Legumen* suturis decurrentibus e basi acuto stipitatum, apice longe acuminatum et mucronatum, circiter 8 cm. longum, 1 cm. latum, glabrum, rectum vel paullo curvatum, aculeis perpaucis vel nullis ad suturas ornatum. *Semina* 4–10.

North India. Along the whole of the outer Himalayan Range from Afghanistan to Assam at low elevations and in the forests of the Terai and Bhabar tracts, in the East up to about 1500 m. Southwards to the Ganges and Chota Nagpore.

Central India. At Gwalior (*Maries*).

Mimosa Barberi, *Gamble* [Leguminosae-Mimosoideae]; *M. himalayanae,* Gamble, affinis legumine angustiore et foliorum pinnis paucioribus pinnulis minoribus differt.

Frutex erectus, ramis striatis angulosis puberulis parce aculeatis. *Folia* bipinnata, 10–12 cm. longa, rhachi puberula parce aculeata; pinnae 6–8-jugae, 2–4 cm. longae; foliola 16–20-paria, 4–7 mm. longa, 2–3 mm. lata, oblonga, apice mucronata, basi semi-rectangularia, hirsuta, costa lateri superiori propinqua, nervis ad costae latus inferius 1–3 arcuatim junctis; stipulae lineares; stipellae minutae. *Flores* rosei, in capitulis axillaribus pedunculatis circiter 7 mm. diametro ramulorum apices versus. *Calyx* campanulatus, 1 mm. longus, glaber, dentibus 4 brevibus. *Corolla* infundibularis, 2·5 mm. longa, glabra, lobis 4 brevibus. *Stamina* 8, longe exserta. *Ovarium* puberulum. *Legumen* longe- (5–7 mm.) stipitatum, curvatum, basi acutum, apice acutum et mucronatum, 8–10 cm. longum, 8–10 mm. latum, glabrum, suturis haud sinuatis aculeis perpaucis vel nullis ornatis. *Semina* 8–10.

North India. At Bogdwar, Assam? *Wallich Cat.* 5289 A2 (ex Herb. Ham.).

Central India. At Tummileru, Godavari Agency, Dec. 1902, *Barber* 5282.

This species was, inadvertently, given in the 'Flora of the Madras Presidency' p. 421 as *M. angustisiliqua,* a name which would seem to be inadmissible.

Mimosa Prainiana, *Gamble* [Leguminosae-Mimosoideae]; *M. hamatae,* Willd., et *M. polyancistrae,* Benth., affinis, ab illa foliis multo longioribus et leguminibus glabris, ab hac pinnis regularibus 5–7-jugis et foliolis majoribus approximatis subtus minute glandulosis differt.

Suffrutex erectus, in ramulis et foliorum rhachi et pedunculis aculeis multis recurvis ornatus, fere glaber et glaucescens. *Folia* bipinnata, 5–9 cm. longa; pinnae 5–7-jugae, 2 cm. longae, 1–2 cm. distantes, rhachi pubescenti; foliola 7–11-juga, oblonga, basi semicordata, 5–7 mm. longa, 2–3 mm. lata, subtus minute glandulosa, glabra, nervis lateralibus inferioribus 3–4 inconspicuis, superioribus obscuris; stipulae lineares; stipellae minutae. *Flores* rosei, in capitulis pedunculatis axillaribus circa 1 cm. latis ramulorum apices versus pauciculatis; pedunculi 1·5–2·5 cm. longi, fere semper aculeis recurvis ornati, pubescentes; bracteae

minutae, caducae; bracteolae sub calyce clavatae. *Calyx* perbrevis, ciliatus, vix 1 mm. longus, dentibus minutis acutis. *Corolla* infundibularis, 2 mm. longa, ad apices loborum acutorum minute puberula. *Stamina* 8, longe exserta. *Ovarium* minute pubescens vel glabrum. *Legumen* curvatum, glabrum, obtusum vel paullo acutum, ad 10 cm. longum, 10–12 mm. latum, suturis sinuatis aculeis reflexis conspicue ornatis. *Semina* 6–8 albuminosa, cotyledonibus planis orbicularibus 4 mm. latis.

Central India. Central Provinces, at Nagpore and Chanda, H. H. Haines 3251, 3249.

South India. Kistna District, at Masulipatam and Bezwada, *Gamble* 12603, 21757; Anantapur District, at Penekacherla, 360 m., *Gamble* 20832; Hyderabad, *Meebold* 1512; Kurnool District, at Atmakur, *Bourne* 4701 (leaflets rather larger and more distant, peduncles longer and less prickly).

West India. At Poona, *Jacquemont* 459.

II.—MOMORDICA COCHINCHINENSIS.

During the work connected with the preparation of the Monograph on "The Genus Strychnos in India and the East," by Capt. A. W. Hill, *K.B.*, Nos. 4–5, 1917, information was received from Mr. W. J. Tutcher, Director of the Botanical and Forestry Department, Hongkong, that seeds of *Momordica cochinchinensis*, Spreng., received from Szechuen, were sometimes sold in Hongkong as Strychnos seeds, and on sending for seeds of *Strychnos Nux-vomica*, L. he had received seeds of the *Momordica*. He added "I am informed by the Imports and Exports Office, Hongkong, that seeds of *Momordica cochinchinensis* are imported as *Strychnos Nux-vomica* seeds under the name of 'Muk Pit Tsze' from Annam and Haipong . . . . In a note I have received from Mr. A. N. Pullen, Government Apothecary, Hongkong, he says *Momordica cochinchinensis* seeds are certainly poisonous and appear to contain alkaloids similar, if not identical, with those contained in *Strychnos Nux-vomica*." In order to test the validity of this suggestion, seeds of the *Momordica* were submitted for examination to Professor H. G. Greenish, Director of the Pharmacy Research Laboratory of the Pharmaceutical Society of Great Britain, and under his supervision an investigation was conducted by Mr. E. R. Baines which resulted in the following report:—

Examination of the seeds of *Momordica cochinchinensis* received from the Royal Botanic Gardens, Kew.

"The average weight of each seed was 3·13 grammes, the seed-coats constituting 36·7 per cent. of the total weight and the kernels 63·3 per cent.

From part of the specimen received the seed-coats were separated and powdered. The moisture and ash were then determined and the powder exhausted with petroleum spirit, ether, chloroform and alcohol successively in a Soxhlet extractor.

The solutions obtained were evaporated to dryness and the residue dried at 100° C. and weighted. Each residue was then tested for alkaloids. The results may be tabulated as follows:—

	Per cent. of seed-coat.	Per cent. of seed.
Moisture	11·20 ...	—
Ash	1·20 ...	—
Petroleum spirit extract ...	0·33 ...	0·12
Ether extract	0·16 ...	0·06
Chloroform extract	0·44 ...	0·16
Alcohol extract	1·62 ...	0·59

No alkaloid was found in any of the residues.

The residue from the chloroformic solution was slightly green in colour and contained long needle-shaped crystals insoluble (or very sparingly soluble) in absolute alcohol. The quantity was too small to allow of their further examination.

The kernels were submitted to similar treatment. During the drying the colour changed from whitish to brownish, indicating that some change had taken place. The determination of the moisture is therefore unreliable and the figure obtained (1·56 per cent.) is not included in the table.

	Per cent. of kernels.	Per cent. of seed.
Petroleum spirit extract ...	47·06 ...	28·90
Ether extract	1·03 ...	0·65
Chloroform extract	0·17 ...	0·11
Alcohol extract	3·44 ...	2·18

No alkaloid was found in any of the residues.

The petroleum spirit extract was a pale brown, viscous oil. On exposure to the air it rapidly formed a film on the surface, and on further exposure in a flat-bottomed dish it was converted into a whitish, solid mass, easily reducible to a white powder. This powder was now insoluble in petroleum spirit and the usual solvents for fixed oils. This behaviour is similar to that of Chinese Tung Oil (from *Aleurites cordata*) which this oil also resembles in certain other of its characters.

The chloroformic extract contained needle-shaped crystals, insoluble in absolute alcohol, similar to those observed in the corresponding extract from the seed-coats.

The peculiar properties of Chinese Tung Oil render it valuable for certain technical purposes. In 1911 Hankow exported to foreign countries 6,143 tons, and to other Chinese ports 37,851 tons. In 1912 Germany imported 6,796 tons.

It is possible that the oil of *Momordica cochinchinensis* could be utilised in a similar way and it might prove a valuable oil if it could be obtained in sufficient quantity and at a suitable price. It is well worthy of further investigation for which purpose larger quantities of the seeds would be necessary."

In a letter accompanying the report Prof. Greenish wrote "So far no alkaloid has been found. The seeds contain a quantity of

fixed oil of remarkable character: it is described by Dymock and Hooper in *Pharmocographia Indica.* It rapidly dries (? by oxidation) to a solid which is easily powdered and then is insoluble in the usual fat solvents. We are examining this a little further. We have also found a crystalline substance, but in quantity so small that I fear we cannot do anything further with it unless we could get a much larger quantity of seed."

Ten pounds of seeds were subsequently obtained from Hongkong, and a further study of the oil was made under the direction of Prof. Greenish, by Messrs. C. E. Corfield, F.I.C. and E. Caird, B.Sc., A.I.C., in the Research Laboratory of the Pharmaceutical Society. The manner and the results of the research were communicated in the following report:—

The Fat of Momordica Seeds.*

At the request of the Assistant Director of the Royal Botanic Gardens, Kew, an examination of the fat contained in the seeds of *Momordica cochinchinensis,* Spreng. was undertaken with the view of ascertaining whether it might prove of commercial value.

Momordica cochinchinensis is a cucurbitaceous plant indigenous to Bengal, Tenasserim, the Deccan Peninsula, Formosa, and the Philippine Islands. The seeds are described by Hooker (Flora of British India, II. p. 618), as "$\frac{7}{8}$ by $\frac{5}{8}$ by $\frac{1}{5}$ in. thick, many, horizontal, irregular, ovate, compressed, black, corrugated on the margins, sculptured on the faces."

Very little information has been published concerning the fat of these seeds. In the *Pharmacographia Indica*† the statement is made that the seeds yield to light petroleum ether 43·74 per cent. of a slightly greenish oil which, smeared on a glass plate and exposed to a temperature of 100° C. could be scraped off the glass as a white powder which, when boiled with petroleum ether, yielded only a trace of oil.

A general examination of the seed-coats and kernels has been made by Greenish and Baines, with the following results:—

The average weight of each seed was 3·13 grammes, of which the seed coat weighed 36·7 per cent., and the kernels 63·3 per cent.

A.—Seed-coats.

The powdered seed-coats were extracted successively with different solvents; the solvent evaporated, and the residue dried at 100° C.

	Per cent. of seed-coat.	Per cent. of seed.
1. Petroleum spirit extract ...	0·33	0·12
2. Ether extract	0·16	0·06
3. Chloroform extract	0·44	0·16
4. Alcohol extract	1·62	0·59

No alkaloid was found in any of the residues.

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* See Pharmaceutical Journal and Pharmacist, Jan. 17, 1920, pp. 43-44.

† *Pharmacographia Indica,* ii, p. 77.

B.—Kernels.

These were submitted to a process of exhaustion similar to that applied to the seed-coats.

	Per cent. of kernel.	Per cent. of seed.
1. Petroleum spirit extract ...	47·06	28·90
2. Ether extract	1·03	0·65
3. Chloroform extract	0·17	0·11
4. Alcohol extract	3·44	2·18

Again, it is interesting to note that no alkaloid was present in the residue. The residue from the petroleum spirit extract was a pale brown, viscous oil. On exposure to air, it rapidly filmed on the surface, and on continued exposure it was converted into a whitish solid mass, easily reducible to a powder.

The result of these experiments led to the present examination of the seeds, with a view to ascertaining as to whether the oil would be of commercial value as a drying oil.

Since, as will be shown later, the heating of the oil to a temperature approaching 100° C. had the effect of altering the composition of the oil, a method, other than that of extraction by means of a solvent and subsequent evaporation, was employed. Cold compression yielded little, since the fat was fairly solid. With the application, however, of slight heat the fat was readily yielded, and a method of extraction based upon this result was adopted. After removal of the seed-coats the kernels were coarsely powdered and submitted to pressure, the necessary heat being obtained by means of a steam coil round the press, adjusted to produce in the mass, a temperature of about 40° C. The fat, of which a good yield was obtained, was greenish-brown in colour; had an unpleasant and penetrating odour; on cooling solidified to a pale green granular mass; when worked at atmospheric temperature it became fluid. The green colour was most probably due to traces of chlorophyll from the coating of the cotyledons.

On examination the fat gave the following constants:—

Saponification value	185·2
Acid value	1·9
Iodine value	23·4
Refractive index (40° C.)	1·496
Ester value	183·3
Melting point	28° C.–32° C.
Unsaponifiable matter	a trace

After saponification of the fat the alcohols were separated, and were found to consist principally of glycerol, the residue giving no evidence of the presence of wax-alcohols. The fatty acids, on separation, were found to be yellowish-brown in colour and solid. The following constants were observed:—

Melting point	46°–51° C.
Solidifying point	44°–42° C.
Acid value	188·3
Iodine value	about 40

Since some considerable difficulty was encountered in determining the iodine value, the figure is not taken as final. Apparently the absorption is accompanied by the formation of some unstable compound, which is decomposed by sodium thiosulphate. From these constants, it appears that the fat consists chiefly of the glyceryl esters of fatty acids, the larger portion of which are saturated, but no attempt has been made to determine the composition of the fat.

On exposing the fat to the atmosphere, a change in colour and in form was noticed. The fat gradually lost its green colour and assumed a pale yellow shade; a marked tendency for films to agglomerate was noticed, and finally it became granular in appearance. A systematic examination of these films was conducted with a view to determining the cause of the changes. The following tables will show the course of the experiments:—

A.—3·9536 *grammes, exposed to air and light.*

Time of exposure in days.	Actual gain.	Gain per gramme per day.
1 ...	0·0024 gm. ...	0·00061 gm.
2 ...	0·0070 „ ...	0·00177 „
3 ...	0·0216 „ ...	0·00546 „
4 ...	0·0312 „ ...	0·0078 „
5 ...	0·0504 „ ...	0·00425 „

These figures are no measure of complete change, since, owing to agglomeration, the lower layers were not sufficiently exposed.

B.—3·5913 *grammes, exposed to air, without access of light.*

Time of exposure in days.	Actual gain.	Gain per gramme per day.
1 ...	0·0003 gm. ...	0·0000835 gm.
2 ...	0·0011 „ ...	0·0003063 „
3 ...	0·0025 „ ...	0·0006961 „
4 ...	0 0074 „ ...	0·002060 „
7 ...	0·0082 „ ...	0·000761 „

In this experiment, there was no agglomeration, and the only change in form was the appearance of small white points in the green exposed surface.

C.—3·9894 *grammes, exposed to light in nitrogen.*

For a period extending over seven days no change in weight took place.

From the above figures, it is evident that the change observed is one of oxidation, which is immensely accelerated by the presence of light, since in that experiment in which the fat was excluded from light the change was extremely small, and only affected the most exposed portions. The effect that this oxidation has upon the solubility of the fat in the ordinary solvents was next ascertained. The data are tabulated below, and will again

show that there was practically no change when the fat was kept in the dark:—

	Petroleum spirit.	Ether.	Carbon tetrachloride.	Alcohol 97%.
Original fat	Soluble ...	Soluble ...	Soluble ...	Insoluble.
Exposed in light	Insoluble ...	Insoluble ...	Insoluble ...	Insoluble.
Exposed in dark	Faintly opalescent solution	Faintly opalescent solution	Faintly opalescent solution	Insoluble.

Lastly, the effect of heat upon the appearance and properties of the fat was observed:—

A.—3·5712 *grammes, exposed to air and light at* 100° *C.*

Time of exposure in days.	Actual gain.	Gain per gramme per day.
1 ...	0·1912 gm. ...	0·05352 gm.
2 ...	0·0614 „ ...	0·03714 „
3 ...	0·0140 „ ...	0·00392 „
4 ...	nil.	nil.

At this point the weight of the film had become constant, indicating that complete oxidation, and other change, if any, had occurred during the period of three days. The appearance of the heated film was markedly different from that of the film exposed at atmospheric temperature. The green colour was lost and the fat assumed a granular, gelatinous form, of a pale brown colour, finally becoming stiff, and easily disintegrated. The effect of heating during oxidation was, as in the case of oxidation at ordinary temperatures, to render the product insoluble in the fat-solvents petroleum spirit, ether, and carbon tetrachloride, while it remained insoluble in alcohol.

The following is a record of observations made on heating the fat slowly from 15° C. to 240° C.:—

15° C.– 50° C.—The fat became less granular, finally assuming a homogenous appearance, and was of a dark brown colour.
50° C.–100° C.—No change observed, except that the colour assumed a redder tint.
100° C.–110° C.—More transparent.
120° C.–130° C.—Colour still lighter.
130° C.–180° C.—Appearance of small bubbles, probably due to the escape of a small quantity of volatile matter.
200° C.–240° C.—A greenish-brown mobile liquid.

On cooling, the fat remained as a brown, viscous liquid of the consistency of castor oil, and the solubility remained as that of the original fat. On exposure in thin layers this liquid did not exhibit the character previously recorded of the fat. During two days, no film appeared, whereas on further exposure the thinnest portions formed a transparent skin of the nature of varnish.

In conclusion, the evidence is that the fat shows certain characteristics of drying oils, such as Tung Oil, without the property of producing a varnish as in the case with drying oils, such as linseed oil, whereas, after heating, it behaves as a semi-drying oil, and it would seem that, in this condition, admixed with drying oils, it might be used in the production of paints and varnishes.

A consignment of seeds of *Momordica cochinchinensis* received through the kind offices of Mr. W. J. Tutcher, Hongkong, was sent to the Imperial Commissioner of Agriculture, West Indies (*see* Agric. News, Feb. 22, 1919). Some of these were entrusted to Mr. J. Jones, Curator of the Botanic Gardens, Dominica, and in the Agric. News of November 1, 1919 (vol. xviii, No. 457), on p. 347, it is reported a fruit has matured on one of the plants raised from the seed received in February. The fruit weighed 3¾ lbs. and contained 42 seeds, weighing 6 ozs. Agric. News, Dec. 13, 1919, p. 393.

It is hoped that the plant may be grown successfully in the West Indies and the oil from the seeds may be found to be of commercial value.

Momordica cochinchinensis has been figured in the Botanical Magazine (Ser. III, vol. xv), Tab. 5145, and there is a description of the plant with a figure in Catalogue des Produits de l'Indo-Chine, Tome i, p. 180, where it is stated that a well-clarified oil is made from the seeds.

III.—CLEMATOPSIS, A PRIMITIVE GENUS OF CLEMATIDEAE.

J. Hutchinson.

The genera *Clematis* and *Naravelia*, comprising the tribe *Clematideae* of *Ranunculaceae*, have generally been regarded as sharply differentiated from the remainder of the family by their usually shrubby habit, opposite leaves, and induplicate-valvate sepals.* And the Tribe *Clematideae* is so described in the majority of local floras and in textbooks. While looking over the genus *Clematis* recently, however, I was impressed by the markedly *imbricate* aestivation of the sepals of several species from Madagascar and South Tropical and Subtropical Africa. This aestivation appeared superficially to be of the ordinary imbricate type, but on dissection of the buds of several species, the types of aestivation shown in diagrams 1–4 were found to occur. These examples are remarkable in that they show almost every degree of aestivation linking up the imbricate with the induplicate-valvate type. In diagram 1, which is drawn from a flower of *Clematopsis scabiosifolia*, the aestivation is simply imbricate; in no. 2, that of *C. speciosa*, it is partly imbricate and

* In the addenda to vol. i. of Benth. & Hook. f. Gen. Plant. the following note occurs:—"Clematis, in charactere, post Sepala . . . . . valvata, adde . . . . . rarius (in speciebus paucis Africae tropicae) imbricata." Prantl. (Engl. & Prantl. Pflanzenf. iii. 2) has a section of *Clematis* with imbricate aestivation which he named *Pseudanemone*.

partly induplicate-valvate; in no. 3, *C. Stanleyi*, we see a gradation which links up with no. 4, *C. Kirkii*, where the aestivation approaches most nearly that of typical *Clematis*, *i.e.*, induplicate-valvate, except that the overlapped margins are not inflexed.

Diagrams showing different types of aestivation in *Clematopsis*.

In the early part of last century the MSS. name *Clematopsis* appears to have been given by Bojer to a few Mascarene species showing this feature, the name first appearing as a *nomen nudum* in Hooker's Icones Plantarum, vol. i. t. x. (1837), wherein several of the species are described as *Clematis*. At tab. 10 of that work, which depicts *Clematis Bojeri*, Hook. [=*Clematopsis villosa*, Hutchinson], Sir William Hooker makes the following observation:—"This is one of several species of Clematis sent me from the island of Madagascar by the late Dr. Lyall, differing strikingly from any described species, and of which has been constituted a new genus in Mr. Bojer's MSS. under the name of *Clematopsis*. But I am not aware of any character to warrant such a separation. All have singularly large flowers and most of them very long peduncles."

As a *valvate* aestivation has no doubt been derived from an *imbricate* one, at any rate in the *Ranales*, the phyletic significance of this remarkable transition should not be lost sight of, linking up, as it clearly does, the tribes *Anemoneae* (through *Anemone* § *Pulsatilla*) and *Clematideae*. It seems desirable, therefore, that Bojer's views as to its generic importance, though expressed only by the MSS. name, should be maintained. If we take into account the somewhat slender means by which several other genera of *Ranunculaceae* are separated, then *Clematopsis* has good claims to recognition. It is true, as remarked upon by Baillon,* that in some of the larger-flowered species of *Clematis*, such as *C. florida*, from which many of the beautiful garden races have been derived, the sepals become imbricate *after* the flowers have opened, but in the bud stage they are valvate.

In regard to the opposite leaves, there is an occasional occurrence which seems to strengthen the view as to the intermediate position of *Clematopsis* between *Anemone* (alternate leaves) and *Clematis* (opposite leaves). This is that when the nature of *C. Stanleyi* (q.v.) is disturbed by cultivation, it sometimes produces *alternate* leaves, thereby becoming to all intents and purposes a species of *Anemone*. Another "*Anemone* feature" is the involucrate leaves of three Angolan species (*see* key).

* Histoire des Plantes, i, 87 (1867).

The species of *Clematopsis* found in the elevated regions of Angola would appear in some places to form almost a dominant feature of the vegetation. According to the Welwitsch Catalogue of Angolan plants, the *Ranunculaceae* produce a striking effect upon the physiognomy of the forest landscape by the presence of immense masses of two erect species [of *Clematopsis*], so that large tracts of pasture ground, situated amidst the forests, during the flowering season, look at a distance as if covered with snow. Whilst on an excursion towards the confluence of the Lopollo and Ferao streams, Welwitsch "enjoyed ample opportunity to admire the scarcely imaginable magnificence of the two erect species each with whitish-red flowers 2–2½ in. in diameter, and with stems 3–4 ft. high."

Whether, in connection with the theory here advanced that *Clematis* has probably arisen through *Clematopsis* from the genus *Anemone*, the southern Plateau of Africa, part of the ancient "Gondwana Land" of Suess, which still connected the African continent with Madagascar and India as late as the Cretaceous, and Africa and Madagascar well into the Tertiary period,* has been the breeding ground for the evolution of *Clematis*, whence they have spread throughout the northern hemisphere, may be left to conjecture. In the absence of some such explanation, it would be difficult to account for the Indo-Malayan genus *Wormia* (*Dilleniaceae*) and the Australian *Hibbertia* in Madagascar. If a detailed examination of the distribution and structural peculiarities of the *Ranunculaceae* from the Southern Hemisphere were undertaken, probably some other interesting facts would be brought to light regarding the phylogeny of those from the Northern Hemisphere. It has already been shown in the case of *Caltha*† that the southern species differ markedly from their boreal relatives. The solitary *Anemone* of Tasmania, *A. crassifolia*, Hk. f., is of a very peculiar habit, and it seems a significant fact that the 20 or so species of *Clematis* endemic to New Zealand should all be dioecious, whilst Huth‡ in his monograph of the genus *Delphinium* remarks on the peculiar structure and isolated position of the only two species, *D. macrocentrum*, Oliv. (Ic. Pl. t. 1501) and *D. Leroyi*, Franch., which occur south of the Equator, in the Masai district of East Africa and Kilimanjaro respectively.

I am much indebted to Mr. E. G. Baker, of the Natural History Museum, for allowing me to examine the sketches of *Clematopsis* he made in the Berlin Herbarium, and to Miss D. M. Rolfe for assistance in preparing the plate.

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* cf. Arldt, Die Entwicklung der Kontinente und ihrer Lebewelt, Karten 19–21 (1907).

† The genus *Caltha* in the Southern Hemisphere, A. W. Hill in Ann. Bot. xxxii. 421–435 (1918).

‡ Monographie der Gattung *Delphinium*, in Engl. Bot. Jahrb. xx. 473 (1894).

Explanation of plate:—1, *Clematopsis Stanleyi* (after Bot. Mag.); 2, *C. trifida*; 3, *C, oligophylla*; 4, *C. anethifolia* (after Hook. Ic. Pl.); 5, flower of *C. speciosa* (orig.); all slightly more than $\frac{1}{2}$ nat. size.

Key* to the species of *Clematopsis*.

*Uppermost pairs (or 4) of leaves (of at least the terminal flower) green like the other leaves and not brightly coloured, nearly always remote from the perianth:

Flowers mostly about 3 at the apex of each shoot ... ... 1. *C. Kirkii.*

Flowers solitary at the apex of each shoot or stem:

†Lower leaves simply pinnate, trifoliolate or sub-entire:

‡Stems more or less solitary, erect; African species:

Four of the upper leaves whorled and forming an involucre; Angolan species.

Involucral leaves simple, toothed:

Sepals 6 ... ... 2. *C. Teuczii.*

Sepals 4 ... ... 3. *C. speciosa.*

Involucral leaves trifoliate, with narrow leaflets ... ... 4. *C. chrysocarpa.*

Upper leaves in distant pairs, not forming an involucre:

Densely tomentose all over; lateral leaflets narrow, entire or unidentate; Angolan species ... 5. *C. argentea.*

Laxly pilose or shortly pubescent; lateral leaflets broad, usually with more than one tooth:

Leaves up to 18 cm. long; sepals strongly ribbed on the back 6. *C. katangensis.*

Leaves not more than 10 cm. long; sepals not ribbed:

Achenes not longer than broad, more or less rhomboid, with long and very slender tails sparsely pilose towards the tips... 7. *C. Oliveri.*

Achenes much longer than broad, narrowly turbinate, with comparatively short tails densely pilose to the tip ... ... 8. *C. Stuhlmannii.*

‡‡Stems several from a decumbent rhizome; pedicels elongated; Mascarene species ... ... 9. *C. trifida.*

††Lower leaves more or less bipinnate, rather roughly and permanently hairy; Angolan species ... ... 10. *C. scabiosifolia.*

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* This key is as good as can be put together from the material seen, which in some cases is rather scanty.

†††Lower leaves more than bipinnate, much divided with rather narrow segments:
Leaves rather coarse, more or less densely hairy; African species ... 11. *C. Stanleyi.*
Leaves usually finely cut, glabrous or nearly so; Mascarene species:
Leaves about 3 cm. long; segments short about 1·5 mm. broad ... 12. *C. oligophylla.*
Leaves over 5 cm. long, segments long and narrowly linear, scarcely 1 mm. broad ... ... 13. *C. anethifolia.*

**Uppermost pair of leaves coloured and bract-like, entire or sub-entire, fairly close up to the perianth, sharply differentiated from the foliage leaves:
Leaves finely divided, segments about 2–5 mm. broad ... ... 14. *C. pimpinellifolia.*
Leaves simply pinnate, leaflets 1·5-2 cm. broad ... ... 15. *C. villosa.*

1. **Clematopsis Kirkii,** *Hutchinson*, comb. nov.

Clematis Kirkii, Oliv. Fl. Trop. Afr. i. 5 (1868); Eyles in Trans. Roy. Soc. S. Afr. v. 352 (1916). *Clematis villosa*, var. *normalis*, O. Kuntze, Monogr. Clemat. 173 (1885). *Clematis Busseana*, Engl. Bot. Jahrb. xlv. 269 (1910).

Tropical Africa. North-West Rhodesia: Fort Hill, Tanganyika Plateau, 1050–1200 m., July, 1896, *A. Whyte;* Kambole, south-west of Lake Tanganyika, 1500 m., *W. H. Nutt* (1896); Fwambo, *A. Carson* 46, 65. Near Mumbwa, 15° S., 28° E., *Mrs. Macaulay* 601; Katinia Hills, under bushes, *T. Kässner* 2160, 2191. Southern Rhodesia: Odzani River Valley, Umtali district, *A. J. Teague* 23; near Chirinda, 1100 m., *Swynnerton* 1763. Shire Highlands, *J. Buchanan* 80, 428; without definite locality, *J. Buchanan* 638, 763. Portuguese East Africa: Manganja Hills, 900 m., fr. 4 Mar. 1862, *J. Kirk* (type). East African Protectorate: Ussagara Mountains, in damp meadows, about 1700 m., fls. Sept. 1900, *W. Busse* 295. Nyasa Highlands; Kyimbila, 25 Nov. 1907, *G. Stolz* 146. Kavironda, 1200-1500 m., *Scott Elliot* 7022, 7154. Belgian Congo: Sekanju, open plain, 12 Jan. 1909, *T. Kässner* 2988; Kipaila, *T. Kässner* 2543.

2. **Clematopsis Teuczii,** *Hutchinson*, sp. nov.

Clematis villosa, var. *Teuczii*, O. Kuntze, Monogr. Clemat. 174 (1885).

Rhizoma polycephalum; caulis erectus, simplex, longitudinaliter sulcatus, medio 4–5 mm. diametro, pilis longis debilibus reflexis laxe instructus. *Folia* alterna, superiora 4 subverticillata, simplicia, anguste obtriangularia, basi longe cuneata, 12–14 cm. longa, 4–5·5 cm. lata, superne lobulato-dentata, e basi prominenter 5-nervia, utrinque pilis longis debilibus pubescentia; petioli circiter 1 cm. longi, sulcati. *Pedunculus* monocephalus, robustus, circiter 18–20 cm. longus, laxe pubescens. *Sepala* (ex icon. Bakeriano) 6, ovato vel ovato-lanceolata. *Infructescentia*

subglobosa, cinereo-brunnea (*Gossweiler*), circiter 10 cm. diametro. *Achaenia* turbinata, fere 1 cm. longa, pilosa, stylo circiter 5 cm. longo dense sericeo-piloso coronata.

Tropical Africa. Angola: Malange, *Mechow* 305 (only a sketch of type seen at the Natural History Museum, S. Kensington). Malange, on high ground near Sansala Catombe, fr. 16th June, 1908, *J. Gossweiler* 1469.

Mr. Gossweiler described the plant as follows:—"A perennial with many-headed caespitose rootstock; stem strictly ascending, not branched, all parts softly hairy; infructescence globular, silvery brown!"

3. **Clematopsis speciosa,** *Hutchinson*, sp. nov.

Caulis erectus, fruticosus, verosimiliter simplex, profunde sulcatus, longe rufo-pilosus. *Folia* superiora involucrata tantum visa, simplicia, obovata, acuta, basi longe attenuata, circiter 12 cm. longa et 5 cm. lata, dimidio parte serrata, inferne integra, chartacea, utrinque pilis curvatis laxe pilosa; nervi laterales e basi ascendentes, infra prominuli. *Flos* solitarius, speciosissimus, usque ad 15 cm. expansus, longe pedicellatus. *Sepala* 4, ovato-lanceolata, acuta, tenuiter chartacea, ad 7 cm. longa et 3 cm. lata, extra striata et laxe pilosa, intra breviter pubescentia. *Filamenta* pilosa, circiter 1 cm. longa; antherae 0·8 cm. longae. *Achaenia* numerosa, dense villosa, matura non visa.

Tropical Africa. Angola: 15° 05′ E. Long., 12° 44′ S. Lat., alt. 1360 m., *Dr. F. C. Wellman* 1792.

This is a magnificent plant and should be introduced to cultivation.

4. **Clematopsis chrysocarpa,** *Hutchinson*, comb. nov.

Clematis chrysocarpa, Welw. ex Oliv. Fl. Trop. Afr. i. 5, partim (1868); Hiern in Cat. Afr. Pl. Welw. i. 2 (1896). *Clematis villosa*, subsp. *chrysocarpa*, O. Kuntze, Monogr. Clemat. 174 (1885).

Descr. emend.—*Caules* erecti, usque ad 0·75 m. alti, profunde sulcati, medio circiter 5 mm. crassi, patule pilosi, nodiis subvillosis, internodiis plerumque circiter 6 cm. longis. *Folia* opposita, trifoliolata vel rare integra, fere sessilia, superiora verticillata, usque ad 12 cm. longa, prominenter nervosa, parce pilosa, foliolo terminali elongato-oblanceolato breviter petiolulato 5–6 cm. longo 1·5–2 cm. lato apicem versus parce dentato vel subintegro, lateralibus linearibus vel oblongis 4–5 cm. longis superne parce dentatis; petioli 1–1·5 cm. longi, complanati. *Flos* solitarius, longe (usque ad 14 cm.) pedicellatus, pedicello subdense et longe piloso. *Sepala* 4, elliptica, dorso ecostata, apiculata, 3 cm. longa, 2 cm. lata, extra pilosa, intra glabra. *Filamenta* complanata, lata, pilosa, fere 1 cm. longa; antherae 7 mm. longae. *Achaenia* turbinata, 8 mm. longa, appresse pilosa, superne fere villosa, stylo elongato 6 cm. longo flavo-villoso coronato.

Tropical Africa. Angola: Huilla; in shortly bushy, rocky, rather dry stations between Lopollo and Nene, at a place called

Ferra de Sola, not abundant, fl. Feb. Apr. 1860, *Welwitsch* 1222. Kubango; apparently widely caespitose, stems erect, 1–2 ft. high, leaves fleshy, deep green; flower terminal, resembling a large tulip in shape, all parts lurid white, on a decayed and overgrown anthill in moist meadow near the fort Colui, 14–10–05, *Gossweiler* 2153, 3642.

Hiern (l.c.) points out that Grant's specimen from Usui district, Uganda, is probably the same as the plant named *C. Stuhlmannii*, Hieron. In the present paper it is described as *Clematopsis Oliveri*, a near ally of *C. Stuhlmannii*.

C. chrysocarpa is another very fine species, remarkable for the whorled upper leaves forming an involucre after the manner of an *Anemone*. Its lower leaves are, however, strictly opposite and in pairs, as in *Clematis*.

5. **Clematopsis argentea,** *Hutchinson*, sp. nov.

Clematis argentea, Welw. ined. *Clematis villosa*, subsp. *argentea*, O. Kuntze, Monogr. Clemat. 174 (1885); Hiern in Cat. Afr. Pl. Welw. i. 2 (quoad forma *acutiloba*).

Caules e rhizomate lignoso numerosi, erecti, usque ad 1 m. alti, laxe foliati, superne ramosi, ubique dense tomentosi, internodiis superioribus circiter 8 cm. longis. *Folia* inferiora non visa, superiora pinnata, usque ad 12 cm. longa, angusta, utrinque dense appresse villosa, foliolis bijugis, terminali profunde trilobato basi cuneato 4·5 cm. longo 3·5 cm. lato, lateralibus oblanceolatis parce lobulatis apice mucronatis glabrescentibus. *Alabastra* tantum visa, ovoidea, breviter acuminata, externe dense tomentosa. *Infructescentia* circiter 9 cm. diametro; pedicelli circiter 7 cm. longi, tomentosi. *Achaenia* turbinata, sericea, stylo plumoso circiter 6 cm. longo coronata.

Tropical Africa. Angola: Pungo Andongo; frequent in bushy stations about Quifinda, near Quisonda, fr. Mar. 1857, *Welwitsch* 1220.

6. **Clematopsis katangensis,** *Hutchinson*, sp. nov.

Suffrutex erectus, usque ad 1 m. altus; caulis prominenter sulcatus, breviter pubescens, medio circiter 6 mm. crassus, superne subtomentosus. *Folia* pinnata, usque ad 18 cm. longa, foliolis bijugis, terminali elliptico-oblanceolato parce dentato, lateralibus paullo minoribus lobulato-dentatis utrinque brevissime pubescentibus demum fere glabris, nervis infra prominentibus, venis laxis; rhachis sulcata, breviter pubescens. *Flores* solitarii, terminales, circiter 7 cm. expansi; pedicelli circiter 6·5 cm. longi, apicem versus molliter tomentosi. *Sepala* 4, valde crassa, acuta, circiter 3·5 longa et 2·5–3 cm. lata, dorso prominenter 5-costata, breviter appresse sericeo-villosi, 2 interioribus marginibus planis molliter tomentellis. *Filamenta* pilosa; antherae 8 mm. longae. *Carpella* et stylus sericeo-villosa. *Fructus* non visus.

Tropical Africa. Belgian Congo: Katanga; Loooi River, Nov. 1910, *T. Kässner* 3347 (Type in Nat. Hist. Mus.).

7. **Clematopsis Oliveri,** *Hutchinson*, sp. nov.

Clematis chrysocarpa, Oliv. Fl. Trop. Afr. i. 5 (1868), partim, non Welw. *C. villosa*, subsp. *chrysocarpa*, forma *stipulata*, O. Kuntze, Monogr. Clemat. 174 (1885) partim.

Caules e rhizomate polycephalo erecti, sulcati, medio circiter 4 mm. crassi, breviter pubescentes, internodiis 6–8 cm. longis. *Folia* subsessilia, trifoliata vel pinnata, usque ad 10 cm. longa et 6 cm. lata, chartacea, utrinque breviter pubescentia, demum subscabrida, foliolis obovatis parce lobulato-dentatis. *Flores* solitarii, circiter 5 lm. diametro, nutantes? breviter vel longe (ad 12 cm.) pedicellati, pedicello molliter tomentoso. *Sepala* 4 vel 6, oblongo-elliptica, circiter 2·5 cm. longa et 1·2 cm. lata, utrinque molliter tomentella. *Filamenta* complanata, inferne pilosa, superne glabra, 1 cm. longa; antherae 5 mm. longae. *Carpella* ellipsoideo-turbinata, sericeo-pilosa, stylo laxe plumoso 5–6 cm. longo gracili coronata.

Tropical Africa. 'White Nile,' *Petherick* (1862). Uganda: common on waste grounds of Usui, Nov. 1861, *Speke & Grant* 190. Koki, 1200 m., *M. T. Dawe* 391. Elgon District, *Sir Evan James*; between Mumias and Lubwas, 1200–1350 m., *A. Whyte*. British East Africa: Nyanza basin. 1200–1350 m., *E. Battiscombe* 681; without definite locality, *H. Powell* 90. East African Protectorate: Uhehe Mts., *Goetze* 673. North Nyasaland: Kondowe to Karonga, 600–1800 m., July 1896, *A. Whyte*.

8. **Clematopsis Stuhlmannii,** *Hutchinson*, comb. nov.

Clematis Stuhlmannii, Hieron in Engl. Pfl. Ost-Afr., C. 180 (1895). *Clematis Goetzei*, Engl. Bot. Jahrb. xxviii 388 (1900)?

Tropical Africa. Uganda: Hunga, herb with white flowers, fr. Nov. 18, 1903, *A. G. Bagshawe* 381. East African Protectorate: Kagehi, *Stuhlmann* 3491; Kinuni, Karagwe, 1500 m., *Stuhlmann* 1658; Kassesse, Karagwe, 1500–1600 m., *Stuhlmann* 1670; Karagwe and Urundi, 1200–1500 m., *Scott Elliot* 8197.

9. **Clematopsis trifida,** *Hutchinson*, comb. nov.

Clematis trifida, Hook. Ic. Pl. t. 79 (1837).

Madagascar. Grassy hills between Imbositra and Itsimatorhodolana, 19 Dec. 1894, *Dr. Forsyth Major* 714. East Imerina; Andrangoloaka, on hills, flowers milky white, Nov. 1880, *J. M. Hildebrandt* 3687. Central Madagascar, *Rev. R. Baron* 690, 1817. Without definite locality, *Dr. Lyall* (type).

10. **Clematopsis scabiosifolia,** *Hutchinson*, comb. nov.

Clematis scabiosifolia, DC. Syst. i. 154 (1818). *Clematis villosa*, var. *scabiosifolia*, O. Kuntze, Monogr. Clemat. 174 (1885); Hiern in Cat. Afr. Pl. Welw. i. 2 (1896).

Tropical Africa. Angola: Huilla; very abundant and variable, near Lopollo in hot wooded stations, especially in ornamental woods composed of *Strychnos* and *Proteaceae*, fls. Jan., fr. Apr. 1860, *Welwitsch* 1221. South Angola; in thickets near meallie fields on plateau near Humpata, on the way from Limekiln, 1800 m., 4 May, 1909, sepals white, *H. H. W. Pearson* 2629;

near Limekiln, common along edges of meallie field, 1800 m., young fr. 4 May 1909, *H. H. W. Pearson* 2624. Cunene passage, 5 ft. high, in open thickets, fl. 12–2–07. *Gossweiler* 2881.

11. **Clematopsis Stanleyi,** *Hutchinson*, comb. nov.

Clematis Stanleyi, Hook. Ic. Pl. t. 589 (1843); Harv. in Harv. & Sond. Fl. Cap. i. 3 (1859); Watson in Gard. Chron. 1890, ii. 326; Garden & Forest, ii. 513, fig. 65 (1890); Hook. f. Bot. Mag. t. 7166 (1891).

South Africa. Transvaal: Macalisberg, Dec., *Burke* (type). Springbokolakte, Klipfontein, *W. Nelson* 275. Wonderfontein district, *W. Nelson* 344. Between Broukhorstspruit and Middelburg, Dec. 1883, *F. Wilms* 3. Sandy places near Sandfontein, 1320 m., fr. 14 April 1894, *R. Schlechter* 4784. Fields near Doekerhoek, 1560 m., 4 Jan. 1894, *R. Schlechter* 4133. Kuduspoort, Pretoria, *A. Rehmann* 4661. Wonderboompoort, Pretoria, *A. Rehmann* 4590. Without definite locality; *Sanderson*; *Zeyher* 3.

Tropical Africa. Rhodesia: Leshumo valley and forest, Jan. 1876, *Dr. E. Holub*. Near Chirinda, 1050 m., Oct. 1907, *C. F. M. Swynnerton* 358. Batoka Plateau, Feb., small shrub 2–3 ft. high, *C. E. F. Allen* 508. Gweloe on the veldt, Jan. 1905, *T. Gardner* 9. Matabeleland: hills near Selukwe, 1½–2 ft. high, fls. white, tinted with pink, stamens greenish-yellow, Nov. and Dec. 1899, *Hon. Mrs. Evelyn Cecil* 119. "South African Goldfields," 1870, *T. Baines*. Angola: Huilla; near Lopollo, *Welwitsch* 1221 b.

There is a beautiful figure of this species (as *Clematis Stanleyi*), in the Botanical Magazine t. 7166 (1891), and the late Sir Joseph Hooker therein gave some highly interesting notes which support our theory on the connection of *Clematopsis* with *Clematis* and *Anemone*. Hooker says "Few genera of plants present such remarkable divergences in habit and flowers as *Clematis*, and the subject of the present plate shows, perhaps, in this respect the greatest departure from the prevalent characters of its congeners. In fact it most resembles an *Anemone* in foliage and flowers, though no species of that genus has so shrubby a habit. Mr. Watson, indeed, informs me that as grown at Kew *the leaves are sometimes alternate*, a singular fact, which if confirmed,* would leave nothing whereby to distinguish the two genera from one another but the valvate petals [=sepals] of *Clematis*, these being imbricate in *Anemone*." If the reader turns to this plate in the Botanical Magazine, however, he will see at a glance that the same plant of which Sir Joseph was speaking has widely imbricate sepals.

The fact that under cultivation *Clematopsis Stanleyi* may produce *alternate* leaves and thus become almost a true *Anemone* is highly significant in pointing out its origin from the genus *Anemone*. I say "almost a true *Anemone*," for the aestivation of the sepals of *C. Stanleyi* (see diagram no. 3) is very peculiar,

* Mr. Coutts has shown me several pots of *C. Stanleyi* at Kew, in many of which the leaves are alternate.

and is a very graphic example of the way in which *valvation* may have arisen from *imbrication*. Such an aestivation, I think, will not be found in *Anemone* proper.

On the climatic conditions under which *Clematopsis Stanleyi* grows Mr. E. E. Galpin wrote to Kew in July, 1890, as follows: "*Clematis* [=*Clematopsis*] *Stanleyi*, like so many of the smaller plants here, dies down to the roots in the winter. It has turned very cold and was freezing in the night, and at 3 o'clock this afternoon the temperature had not gone above 39° Fahr., which is scarcely what an outsider would expect in a subtropical place like Barberton."

The specimens from Tropical Africa quoted above are included with some reservation; their leaf-segments are mainly broader and less hairy than in typical *C. Stanleyi* from the Transvaal.

12. **Clematopsis oligophylla,** *Hutchinson*, comb. nov.

Clematis oligophylla, Hook. Ic. Pl. t. 80 (1837). *C. villosa*, subsp. *oligophylla*, O. Kuntze, Monogr. Clemat. 173 (1885).

Madagascar. Mountains of Emirra Province, *Bojer*. North East of Ankaratra Mts., *Langley Kitching*. "Central Madagascar," *Rev. R. Baron* 1766, 1817.

13. **Clematopsis anethifolia,** *Bojer ex Hook.* Ic. Pl. sub. t. 78 (1837), nomen.

Clematis anethifolia, Hook. l.c. t. 78. *C. villosa*, subsp. *anethifolia*, O. Kuntze, Monogr. Clemat. 174 (1885).

Madagascar. *Dr. Lyall* 109. Central region, *Rev. R. Baron*. Very abundant on rather dry ground, Arivorarnano, young fr. Jan., *Scott Elliot* 1926.

14. **Clematopsis pimpinellifolia,** *Bojer ex Hook.* Ic. Pl. sub. t. 77, nomen (1837).

Clematis pimpinellifolia, Hook. l.c. t. 77. *C. villosa*, subsp. *pimpinellifolia*, O. Kuntze, Monogr. Clemat. 173 (1885).

Madagascar. In fruit, *Dr. Lyall* 108. Central region, *Rev. R. Baron*, 690, 2004. North Betsileo, Loherano, flowers milky white, Jan. 1881, *J. M. Hildebrandt* 3877.

15. **Clematopsis villosa,** *Hutchinson*, comb. nov.

Clematis villosa, DC. Syst. 154 (1818); *C. villosa*, var. *normalis* forma *Bojeri*, O. Kuntze, Monogr. Clemat. 173 (1885). *Clematopsis suaveolens*, Bojer ex Hook. Ic. Pl. sub. t. 10 (1837). nomen. *Clematis Bojeri*, Hook. l.c. t. 10.

Madagascar. *Dr. Lyall.* 61 (type) Central region, *Rev. R. Baron* 690. North Betsileo; Loherano, flowers milky white, Jan. 1881, *J. M. Hildebrandt* 3877a. Dry ditch in long grass at foot of Andringitra Mt., Jan., *Scott Elliott* 1824. Without definite locality, *Bojer*.

I accept here O. Kuntze's determination of De Candolle's *Clematis villosa*, formerly supposed to have come from India. I have not seen the type specimen, which is in Paris.

IV.—DIAGNOSES AFRICANAE: LXXIII.

1641. **Acmadenia teretifolia,** *Phillips*, comb. nov. [Rutaceae-Diosmeae]; affinis *A. macrostylidioidei*, Schlechter, sed foliis confertis majoribus subteretibus hispidulis differt.

Frutex depressus, lignosus, circiter 0·5 m. altus; ramuli foliorum vestigiis asperati, minute pubescentes. *Folia* subsessilia, subteretia, supra canaliculata, apice obtusa, 3–5 mm. longa, 1 mm. crassa, hispidula, viscida et glandulosa; petioli 0·5–1 mm. longi. *Flores* sessiles, terminales, 2–4-nati; bracteae clavatae, obtusae, 2–3 mm. longae, hispidulae. *Sepala* spathulata, obtusa, 3–4 mm. longa, hirsuta, marginibus membranaceis ciliatis. *Petala* breviter unguiculata, elliptica vel suborbiculata, apice obtusa, 6–6·5 mm. longa, extra pubescentia, ciliolata, ungue oblongo 1–1·5 mm. longo 0·75 mm. lato. *Filamenta* 1 mm. longa, subteretia, glabra; antherae 1 mm. longae, ellipsoideae, apice glandulo parvo sphaerico coronatae. *Staminodia* glanduliformia, 0·25 mm. longa. *Ovarium* sphaericum, 1 mm. diametro, superne pubescens; stylus 1 mm. longus, curvatus, teres, glaber, stigmate capitato. *Fructus* 4 mm. longus, 5 mm. latus, valvis costatis.

Diosma teretifolia, Link, Enum. 237; Sond. in Harv. & Sond. Fl. Cap. i. 376.

South Africa. Clanwilliam Div.: Sneeuwkop Mountain, *Liepoldt* 651. Ceres Div.: Cold Bokkeveld, near Ceres, about 2000 m., *Schlechter* 10098; Gydouw, near Ceres, Dec., *Bolus* 7576. Worcester Div.: Matroosberg, about 2400 m., Jan., *A. Bolus in Herb. H. Bolus* 6360; *Phillips in Herb. Mus. Austr.-Afric.* 11768. Tulbagh Div.: Great Winterhoek, *A. Bolus in Herb. Guthrie* 4188 (partim).

(The following additional records are in the Kew Herbarium:—Worcester Div.: Dutoits Kloof, 600–900 m., Oct.–Jan., *Drège*. Swellendam Div.: Summit of a mountain peak near Swellendam, Jan., *Burchell* 7349).—Ed.

Var. **glabrata,** *Phillips;* a typo ramulis foliisque glabris differt —*Diosma teretifolia*, var. *glabrata*, Sond. l.c.

South Africa. Worcester Div.: Matroosberg, 1650 m., *A. Bolus in Herb. Guthrie* 3968: about 1950 m., *Marloth* 2343. Tulbagh Div.: Great Winterhoek, *A. Bolus in Herb. Guthrie* 4188 (partim).

This species was described by Link as a *Diosma* (*D. teretifolia*), and retained as such by Sonder in the *Flora Capensis*, but on account of the clawed petals and the presence of staminodes it would appear better placed in *Acmadenia*. The Director of Kew was good enough to compare specimens with the Kew material and reports them to be identical with *Diosma teretifolia*, Link.

In both the Great Winterholk and the Matroosberg a glabrous form with shiny leaves is found.

1642. **Craterispermum caudatum,** *Hutchinson* [Rubiaceae-Vanguerieae]; affinis *C. montano*, Hiern, sed foliis caudato-acuminatis fructibus longe pedicellatis differt.

Arbor parva (Aylmer); ramuli sicco laete virides, subangulares, glabri, internodiis 2–3 cm. longis. *Folia* oblonga vel oblongo-elliptica, basi breviter cuneata, apice longe et acute caudato-acuminata, 8–14 cm. longa, 2·5–4·5 cm. lata, tenuiter chartacea, utrinque sublaxe reticulata, glabra, sicco pallide viridia; costa supra impressa, infra prominens, straminea; nervi laterales utrinsecus circiter 8, a costa sub angulo fere recto abeuntes, prope marginem conjuncti, gracillimi; petioli 5–6 mm. longi, supra canaliculati; stipulae cupulatae, caudato-acuminate, 3–4 mm. longae, margine setoso-ciliatae. *Pedunculi* supra-axillares, circiter 6 mm. longi, complanati (fere alati), glabri. *Flores* pauci, dense capitati; bracteae binae, oppositae, triangulari-lanceolatae, acutae, 2 mm. longae, parce ciliatae; bracteae breviter cupulate, minute ciliolatae. *Receptaculum* late obconicum, 1·25 mm. longum, minute-puberulum. *Calyx* 0·65 mm. longus, minute 5-denticulatus et ciliolatus. *Corollae tubus* 4 mm. longus, extra glaber, intra parce pilosus; lobi 5, oblongi, intra breviter cucullati, 2·5 mm. longi, 1·5 mm. lati, intra glabri. *Stamina* exserta; filamenta 2 mm. longa; antherae 1 mm. longae, versatiles, leviter curvatae. *Stylus* gracilis, 3 mm. longus, glaber, stigmate lobulato. *Fructus* globosus, 3 mm. diametro, minute puberulus, pedicellis fructiferis 4 mm. longis.

Tropical Africa. Sierra Leone: Bandajuma, small tree, 10 May, 1914, "Newerri" (Mendi), *G. Aylmer* 78 (type); near Likuru, Talla Hills, Feb. 23, 1892, *G. F. Scott Elliot* 4987; Kenema, Jan. 28, 1915, *N. W. Thomas* 7857, 7891, 7946.

This distinct species may be at once recognised by its small closely capitate inflorescences, the long-pedicellate subumbellate fruits, and the oblong long-caudate leaves.

1643. **Senecio Snowdenii,** *Hutchinson* [Compositae-Senecioneae]; affinis *S. Schultzii*, Hochst., sed planta ubique breviter et dense glandulosa, foliis marginibus minute crenulatis et recurvatis, capitulis anguste campanulatis bracteis paucioribus differt.

Herba usque ad 0·75 m. alta, erecta, ubique dense glandulosa; caulis subsimplex vel parce ramosus. *Folia* numerosa, mox abrupte reflexa, linearia, apice obtusa et cartilagineo-incrassata, basi semiamplexicaulia, 5–6 cm. longa, 5–9 mm. lata, marginibus obtuse crenulatis late recurvatis, utrinque pilis glandulosis dense induta. *Capitula* solitaria, terminalia, vel pauca et laxe corymbosa; pedunculi circiter 2 cm. longi, foliis bracteiformibus paucis ornati. *Involucri bracteae* circiter 14, crassae, extra dense glandulosae, marginibus abrupte membranaceis, circiter 1 cm. longae et 0·75 mm. latae. *Flores radii* 4 cm. expansi, flavi; corollae tubus cylindricus, 6 mm. longus, glaber; lamina lineari-oblonga, apice rotundata, 1·5–2 cm. longa, 5 mm. lata, 4-nervia; pappus albus, tubo parum longior. *Flores disci*: corollae tubus 8 mm. longus, superne sensim latior; lobi 5, obtuse triangulares, 0·75 mm. longi; pappus corollae tubo aequilongus. *Achaenia* parce puberula.

Tropical Africa. Uganda: Mt. Elgon, herb in short grassland, 3600–3900 m., 22 Oct., 1916, *J. D. Snowden* 463.

Named in compliment to Mr. J. D. Snowden, District Agricultural Officer, Uganda Protectorate, who has collected several interesting novelties in the temperate zone of Mt. Elgon.

1644. **Mostuea amabilis,** *Turrill* [Loganiaceae]; species *M. syringaeflorae*, S. Moore, affinis sed foliis minoribus, calycis lobis minus ciliatis, corollis campanulatis praecipue differt.

Frutex parvus, 3–6 dm. altus (ex collectore), ramis glabris vel junioribus adpresse pubescentibus teretibus. *Folia* elliptica vel elliptico-ovata, apice obtusa, rotundata vel leviter emarginata, basi in petiolum pubescentem vix 1 mm. longum abrupte angustata, usque ad 1·7 cm. longa et 1·1 cm. lata, margine forte plus minusve undulata, nervatione utrinque sub-prominente, supra viridia, costa hirsuta excepta glabra, infra pallide viridia, costa et nervis principalibus leviter hirsutis; stipulae interpetiolares 2·5 cm. longae, in dimidio inferiore late vaginatae, superiore aciculares. *Inflorescentiae* axillares vel terminales 3–4-florae; bracteae minutae; pedunculus 5·7 mm. longus, gracilis, glaber; pedicelli usque ad 7 mm. longi, graciles, glabri. *Calyx* 5-lobatus, lobis oblongo-ovatis 1·5 mm. longis 1 mm. latis apice obtusis margine ciliolatis. *Corolla* campanulata, 1 cm. longa, diametro basi 1·3 mm., fauce 4·5 mm., aurantiaca (in siccitate), lobis late ovatis 3·5 mm. longis 4 mm. latis margine minutissime ciliolatis. *Stamina* 5, subaequalia, filamentis 5·5 mm. longis leviter glandulosis. *Ovarium* subcylindricum, 1·5 mm. altum, 0·5 mm. diametro, apicem versus hirsutum; styli 2 mm. longi.

Tropical Africa. Portuguese East Africa: near the mouth of the Musalu River, fl. Dec., *C. E. F. Allen* 90.

1645. **Thunbergia** (**Euthunbergia**) **prostrata,** *Turrill* [Acanthaceae-Thunbergieae]; *T. primulinae*, Hemsl., affinis sed foliis latioribus, floribus longe pedunculatis minoribus praecipue differt.

Herba gracilis, prostrata, caulibus teretibus, leviter pubescentibus. *Folia* late ovata, apice obtusa vel subacuta, basi saepe obliqua, plus minusve truncata vel subcordata vel cuneata, petiolo 7 mm. incluso usque ad 5·2 cm. longa et 5·5 cm. lata, utrinque leviter pubescentia, margine ciliata, costa et nervis pagina inferiore prominentibus, superiore basi excepta impressis. *Flores* in foliorum axillis solitarii, pedunculo 8 cm. longo asperopubescente; bracteae oblique ovatae, apice acutae, basi cordatae, 2·5 cm. longae, 1·5 cm. latae, nervis parallelis 7–9 prominentibus, extra pubescentes, intus glabrae. *Corollae* tubus cylindricus, arcutus, 1·6 cm. longus, 3 mm. supra basem leviter constrictus et intus in annulo duplici leviter puberulus, basi 3·5 mm. diametro fauce 5 mm. diametro; lobi 5, inter se subaequales, 8 mm. longi, 1 cm. lati, flavi. *Stamina* 4, filamentis duobus 6 mm. longis, duobus 3·5 mm. longis, basi pubescentibus; antherae 3 mm. longae, thecis subaequalibus calcaratis; pollinis granula sphaeroidea, 95 μ diametro. *Discus* annularis, inconspicuus. *Ovarium* ovoideum, bilateraliter compressum, 3 mm. altum, 2·5 mm. diametro,

glabrum; stylus cum stigmate 2·5 mm. longo bilabiato lobis aequalibus rotundatis 1·1 cm. longus.

Tropical Africa. British East Africa: Common on exposed grasslands, 2150–2460 m.; grown at Kew from seeds collected and communicated by *E. Battiscombe*.

It is said to be a prostrate herb, growing where there is abundant rainfall, amongst grass, and never climbing.

1646. **Asystasia amoena,** *Turrill* [Acanthaceae-Justicieae]; *A. Colae*, Rolfe, affinis sed foliis lanceolato-ellipticis majoribus, bracteolis calyce brevioribus, corollis majoribus facile distinguitur.

Herba erecta, caulibus teretibus patenter hirsutis. *Folia* lanceolato-elliptica, apice acuminata, basi gradatim angustata, usque ad 1·4 dm. longa, 3·5 cm. lata, costa nervisque pagina superiore subprominentibus, inferiore prominentibus, nervis lateralibus utrinque circiter 6, costa nervisque infra leviter hirsutis, alioqui glabra; petiolus circiter 1 cm longus, hirsutus. *Inflorescentia* terminalis, patule hirsuta, usque ad 1·8 dm. longa; bracteae lineares vel lineari-lanceolatae, 0·6–3·5 cm. longae, plus minusve hirsutae; pedicelli 0·8–2 cm. longi, patule hirsuti; bracteolae late ellipticae, apice obtusae, 1·2 cm. longae, 9 mm. latae, fere 3 mm. infra apicem positae, dorso hirsutae, intus glabrae. *Calyx* 5-fidus, segmentis subaequalibus anguste elliptico-lanceolatis apice subacutis 1·5–2 cm. longis utrinque glandulosis. *Corolla* late infundibuliformis, 3·5 cm. longa, basi 2 mm. diametro, 2 mm. supra basem dilatata et 3·3 mm. diametro, 7 mm. supra basem constricta et intus pilorum annulo praedita, alioqui glabra, fauce 8 mm. diametro, lobis 5 fere aequalibus oblongis obtusis vix 1 cm. longis 4 mm. latis. *Stamina* 4, glabra, filamentis 2·3 cm. longis, antheris 4 mm. longis thecis 2 parallelis instructis; pollinis granula breviter ellipsoidea circiter 56 μ longa et 48 μ diametro. *Discus* annularis, 1 mm. altus, glaber. *Ovarium* obovoideum, 2·5 mm. altum, 2 mm. diametro, glabrum; stylus 2·9 cm. longus, apice breviter bifidus, superne leviter hirsutus praeterea glaber. *Capsula* spathulata, 2·2 cm. longa, 9 mm. lata, glabra. *Semina* 4, plana, fere orbicularia, 7–8 mm. diametro, rugosa, flava.

Tropical Africa. Sierra Leone: undergrowth in Rain Forest; common round York Pass, *Lane-Poole* 180.

1647. **Leucadendron uniflorum,** *Phillips* [Proteaceae-Proteae]; species capitulis ♀ unifloris distinctissima.

Suffrutex 1·2 m. altus. *Rami* et ramuli glabri vel pubescentes. *Folia* 1–2·6 cm. longa, linearia, apice obtusa, basi angustata, glabra. *Inflorescentia* ♂ pedunculata, terminalis, 6 mm. longa, 4 mm. lata; pedunculus 1 cm. longus. *Bracteae* 2·5–3 mm. longae, ovatae vel lineares apice obtusae, pilosae. *Perianthii tubus* 3 mm. longus, cylindricus, villosus; segmenta 1 mm. longa, pubescentia; lobi 2·5 mm. longi, lineari-lanceolati, apice obtusi, pubescentes. *Antherae* 2 mm. longae, lineares. *Stylus* 1·5 mm. longus, glaber; stigma 2 mm. longum, clavatum. *Inflorescentia* ♀ uniflora, sessilis, 1 cm. longa, 7 mm. lata. *Bracteae* 4·5–9 mm.

longae, 4–6 mm. latae, concavae, ovatae, vel ovato-lanceolatae, apice obtusae, aliquando acuminatae, villosae. *Perianthii tubus* 9 mm. longus, villosus; segmenta 4 mm. longa, linearia, villosa; limbus 3 mm. longus, linearis, apice obtusus. *Staminodia* 2·5 m. longa. *Ovarium* 2 mm. longum, 1 mm. latum, globosum, villosum; stylus 8 mm. longus, glaber.

A shrub 1·2 m. high with 7–12 branchlets 12–19 cm. long arranged in a whorl on the branches, which are produced 24–26 cm. beyond the whorl and bear the inflorescences. *Branches* and branchlets glabrous or very finely pubescent. *Leaves* similar in both sexes, 1–2·6 cm. long, linear, obtuse, narrowed to the base, glabrous; when boiled out the leaves appear rough which is due to striations in the walls of the epidermal cells.* *Male* inflorescence peduncled, terminal on short axillary shoots; peduncle surrounded by the upper leaves, 1 cm. long, bracteate; head 6 mm. long, 4 mm. in diameter, few flowered. *Flowers* in the axils of bracts. *Bracts* 2·5–3 mm. long, obtuse; finely pilose on the upper half; the outer 1·5 mm. broad, ovate; the inner 1 mm. broad linear. *Perianth-tube* 3 mm. long, cylindric, villous; segments 1 mm. long, pubescent; limb 2·5 mm. long, linear-lanceolate, obtuse, pubescent with glabrescent tips. *Anthers* 2 mm. long, linear. *Style* arising from apex of perianth-tube, 1·5 mm. long, cylindric, glabrous; stigma 2 mm. long, somewhat clavate, minutely bifid at the apex. *Female inflorescence* terminal on short axillary shoots, one-flowered, sessile, 1 cm. long, 7 mm. broad at the base, surrounded by the upper leaves. *Outer bracts* 4·5–7 mm. long, 4–6 mm. broad, concave, ovate, obtuse, some shortly and bluntly acuminate, villous with white hairs; inner bracts 9 mm. long, concave, ovate to ovate-lanceolate, obtuse, villous. *Perianth-tube* 9 mm. long, densely villous, segments 4 mm. long, linear, villous; limb 3 mm. long, linear, obtuse. *Staminodes* 2·5 mm. long. *Ovary* 2 mm. long, 1 mm. in diameter, globose, densely villous; style 8 mm. long, cylindric, glabrous; stigma not seen.

South Africa. Riversdale Division: Muiskraal, near Garcia's Pass, about 320 m., October, *Galpin* 4441, 4442 (and *in National Herbarium*, Union of South Africa 800, 801).

This species approaches *L. corymbosum*, Berg., in habit but differs in having the male inflorescence pedunculate; also allied to *L. ericifolium*, R. Br., but differs in the longer and thicker leaves, and by the fleshy glabrous or almost glabrous male bracts.

1648. **Phyllanthus asperulatus,** *Hutchinson* [Euphorbiaceae-Phyllantheae]; affinis *P. Niruri*, Linn., sed ramulis asperulatis disco ♀ minus lobato differt.

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* Mr. Boodle has examined these leaves and makes the following observations:—

"In a transverse section of a leaf, the cuticle appears slightly warted. This is due to longitudinal cuticular ridges, of which there are usually three or four over each epidermal cell, extending for the greater part of the length of the cell.

A soaked leaf has a rather white appearance owing to reflection of light from a substance occupying the cavities of the epidermal cells, and having sphaerocrystalline structure."

Planta annua, circiter 2·5 dm. alta, in parte superiore tertia ramosa; caulis inferne nudus, stramineus, minute et parce scabrido-puberulus; ramuli foliati, compresso-angulares, marginibus minute asperulati. *Folia* oblongo-elliptica, utrinque rotundata, 0·8–1·2 cm. longa, 4–8 mm. lata, membranacea, glabra, sicco glauco-viridia; nervi laterales utrinsecus 5–6, supra vix evidentes, infra satis prominuli; petioli graciles, circiter 1 mm. longi; stipulae subulato-lanceolatae, acutae, membranaceae, 1 mm. longae. *Flores* monoici, ♂ in parte inferiore, ♀ in parte superiore ramulorum dispositi. *Pedicelli* ♂ brevissimi; sepala 6. obovata, apice rotundata, 1 mm. longa, 1-nervia, membranacea, hyalina, glabra; disci glandulae 6, planae, rotundatae, laeves; stamina 3, filamentis brevissimis in columnam connatis, antheris transverse dehiscentibus. *Flores* ♀ brevissime pedicellati; sepala 6, subacuta, membranacea, viridescentia, marginibus hyalinis, glabra. *Ovarium* laeve, stylis brevibus e basi patentibus apicibus incrassatis bifidis. *Capsula* mox dehiscens, integra non visa, parietibus crustaceis tenuissimis. *Semina* triquetra, dorso convexa, crebre et longitudinaliter sulcata.

South Africa. Kalahari Region: Transvaal; Komati Poort, 320 m., Dec., *Schlechter* 11866.

1649. **Phyllanthus delagoensis,** *Hutchinson* [Euphorbiaceae-Phyllantheae]; affinis *P. heterophyllo,* Muell. Arg., sed stigmatibus subintegris et subsessilibus, foliis minimis dense dispositis differt.

Caules ut videtur e rhizomate lignoso orti, e basi ramosi, sulcati, glabri; ramuli satis foliati. *Folia* late elliptica vel oblongo-elliptica, utrinque obtusa, 3–4·5 mm. longa, 1–2·5 mm. lata, subcoriacea, glabra; stipulae subulatae, membranaceae. *Flores* monoici, masculi in ramulorum parte superiore, foemini in parte inferiore dispositi. *Pedicelli* ♂ breves et graciles; sepala 6, inaequalia, lanceolata, subacuta, usque ad 1 mm. longa, glabra; disci glandulae minimae et rotundatae, laeves; stamina 3; filamenta breviter connata; antherae magnae, transverse dehiscentes. *Pedicelli* ♀ 1–1·5 mm. longi; sepala 6, quam ♂ majora et subaequalia; discus patelliformis, leviter undulatus, carnosus, glaber; stigmata subintegra et fere sessilia; capsula et semina non visa.

South Africa. Eastern Region: Delagoa Bay; Lorenzo Marques, *R. Schlechter* 11663.

1650. **Isachne angusta,** *Stapf* [Gramineae-Paniceae]; spiculis hiantibus versus apices paniculae ramorum congestis et glumis angustis facile distinctu.

Perennis, laxe caespitosa, ad 25 cm. alta, rhizomate gracili, innovationibus extravaginalibus, gemmis cataphyllis tenuibus pubescentibus obtectis. *Culmi* pergraciles, geniculato-ascendentes, teretes, florentes 4–7, steriles, plerumque plurinodi, internodiis magis minusve exsertis superne adpresse pubescentibus. *Foliorum* vaginae arctae, tenuiter pubescentes et ad margines dense ciliatae; ligulae ad marginem breviter ciliatum reductae; laminae lanceolatae, acutae, basi subrotundatae,

1·5–3 cm. longae, 3–6 mm. latae, planae, patentes, rigidulae, subglaucae, glabrae, laeves vel sublaeves, nervis permultis tenuissimis, primariis subtus utrinque circiter 3 subdistinctis. *Paniculae* longe e summa vagina exsertae, ambitu ovatae, 1·5–4 cm. longae, graciles, glabrae; rami primarii obliqui, infimi ad 2–1 cm. longi, ad medium indivisi, abhinc in racemum basi saepe compositum contractum abeuntes; pedicelli inferiores 3–4 mm. longi, summi et racemulorum laterales multo breviores. *Spiculae* hiantes 1·75 mm. longae, pallide vel glauco-virides; rhachillae internodia brevissima, sed distincta. *Glumae* aequales, oblongae, 1–5 mm. longae, subacutae vel obtusiusculae, scaberulae. *Anthoecium inferum* ♂ oblongum, subobtusum: valva tenuiter 5-nervis, pallida, tenuiter chartacea; valvula structura valvae; lodiculae tenuissimae capillaribus, plerumque. *Antherae* filamentis inter stigmatis pilos retentae, 0·25 mm. longae. *Anthoecium superum* ♀, infero applicatum et id paulo excendens, ei simillimum; lodiculae ut videtur 0; stamina ad staminodia minuta vix 0·2 mm. longa clavata redacta.

Bourbon. Without precise locality, *Balfour*.

V.—THE REV. H. F. TOZER AND PLANTS COLLECTED BY HIM IN THE NEARER EAST.

W. B. Turrill.

Amongst a collection of dried plants recently presented to Kew by Miss E. M. Wakefield were found a number of specimens collected in the Balkans and Orient by the Rev. H. F. Tozer. Some of these come from localities which have been very little visited by botanists, such as the Scardus (Shar Dagh or Shar Planina) and Pindus Ranges and Mt. Olympus in Lesbos (Mitylene).

The Rev. H. F. Tozer, M.A., F.R.G.S., was born at Plymouth in 1829 and died at Oxford on 2nd June, 1916. He became a Fellow of Exeter College in 1893 and was a well-known figure in Oxford. He travelled extensively in Europe and the Orient, especially in Greece and the old Turkish Empire. Numerous journeys were made to these interesting regions and many mountain ranges and peaks were climbed. His most noteworthy ascent was that of Mount Argaeus, the highest summit of Asia Minor. His chief works dealing largely with the Nearer East are: "The Highlands of Turkey," 2 vols., 1869; "Lectures on the Geography of Greece," 1873; "Primer of Classical Geography," 1877; Turkish Armenia and Eastern Asia Minor," 1881; "The Church and the Eastern Empire," 1888; "The Islands of the Aegean," 1890; and "History of Ancient Geography," 1897. He edited Finlay's "History of Greece," 1877, and Wordworth's "Greece," 1882, and was also the author of the following articles in the Encyclopædia Britannica, ed. 11: Attica; Euboea; Santorin; Thessaly; Thrace and Trebizond. An

obituary notice of him was published in the Geogr. Journ., vol. 48, p. 176 (Aug. 1916).

The writer desires to thank Dr. G. C. Druce, M.A., F.L.S., and Mr. C. H. Wright, A.L.S., for assistance in tracing the above particulars.

Systematic List of Plants collected by The Rev. H. F. Tozer in the Balkans and Orient.

Ranunculus Villarsii, DC. (R. oreophilus, *M.B.*). Macedonia: Scardus, 1865.

Nigella Damascena, L. Greece: Corinth; Isthmus.

Delphinium orientale, J. Gay. Macedonia: Chalcidice, 1861.

Glaucium flavum, Cr. Macedonia: shores of Athos.

Capparis sicula, Duh. Greece: Euboea, Chalcis.

Dianthus erinaceus, Boiss., var *alpinus*, Boiss. Anatolia: Mt. Ida, 1861.

Dianthus hæmatocalyx, Boiss. et Heldr. Thessaly; Mt. Olympus, 1865.

Dianthus deltoides, L. Macedonia: Scardus, 1865.

Cerastium alpinum, L. Macedonia: Scardus, 1865.

Hypericum olympicum, L. Anatolia: Mt. Ida.

Hypericum Aucheri, Jaub. et Spach. Anatolia: Mt. Ida.

Geranium subcaulescens, L'Her. Macedonia; Scardus, 1865.

Trifolium pratense, L. var. *rumelicum*, Vel. Macedonia: Scardus.

Anthyllis Vulneraria, L. var. *Dillenii*, Schult. Thessaly: Mt. Olympus, 1865.

Anthyllis aurea, Host. Thessaly: Mt. Olympus, 1865.

Astragalus cephalonicus, Presl. Greece: Phocis; Peaks of Parnassus.

Lathyrus grandiflorus, Sibth. Macedonia: Athos.

Geum montanum, L. Macedonia: Scardus, 1865.

Geum coccineum. S. et S. Macedonia: Scardus, 1865.

Potentilla ternata, Koch. Macedonia: Scardus, 1865.

Rosa pendulina, L. Macedonia: Pindus, 1861.

Saxifraga chrysoplenifolia, Boiss. Greece: Morea.

Saxifraga Federici-Augusti, Bias. Macedonia: Athos, 1861. Thessaly: Mt. Olympus, 1861.

Saxifraga heucherifolia. Griseb. Macedonia: Scardus, 1865.

Saxifraga sancta, Griseb. Macedonia: Peaks of Athos, 1861.

Saxifraga Sibthorpii, Boiss. Greece: Phocis; Peaks of Parnassus, near the snow, 1861.

Bupleurum odontites, L. Macedonia: Chalcidice (?).

Asperula arcadiensis, Sims. Greece: Achaea; Megaspelion.

Pterocephalus Parnassi, Spreng. Anatolia: Mt. Ida, 1861.

This species is not uncommon in the mountainous districts of Greece and it has also been found on Athos but, so far as the writer knows, has not been previously recorded from Asia Minor. The nearly related *Pterocephalus Pinardi* takes the place of *P. Parnassi* on the mountains of Asia Minor and specimens from Mt. Ida are in the Kew Herbarium. Both species appear to meet on this mountain massif. *P. Pinardi* is distinguished from

P. Parnassi by its laxer caespitose habit, more divided foliage leaves, and narrow and longer involucral leaves.

Centaurea rupestris, L. var. *athoa*, DC. (pr. sp.) Macedonia: Athos, 1861.

Centaurea rupestris, L. var. *hirtella*, Posp. Anatolia: Ida, 1861.

Hieracium Hoppeanum, Schultes. Macedonia: Scardus, 1865.

Campanula oreadum, Boiss. et Heldr. Thessaly: Mt. Olympus, 1865.

Campanula patula, L. Macedonia: Scardus, 1865.

Bruckenthalia spiculiflora, Rchb. Macedonia: Scardus, 1865.

Datura Stramonium, L. Macedonia: Athos, Iveron.

Atropa Belladonna, L. Macedonia: peak of Athos, 1861.

Thymus Serpyllum, L. Macedonia: Scardus, 1865.

Aristolochia Clematitis, L. Macedonia: Chalcidice, near Erisso.

Euphorbia myrsinites, L. Greece: Phocis; Parnassus.

Daphne oleoides, Schreb. var. *glandulosa*, Bert. Macedonia: Mt. Pindus.

Daphne oleoides, Schreb. var. *puberula*, Jaub. et Spach. Greece: Phocis; Mt. Parnassus. Thessaly: Mt. Olympus, 1865.

Orchis papilionacea, L. Lesbos (Mitylene): Pyrrha, 1886.

Scilla bifolia, L. Lesbos (Mitylene): Mt. Olympus, 1886.

Anthericum Liliago, L. Thessaly: Mt. Olympus, within the region of the trees.

Sternbergia lutea, L. Greece: Arcadia; Muchli and Karytena, Sept. 1882.

Sternbergia colchiciflora, W. et K. Macedonia: northern heights of Pindus.

Gagea foliosa, Presl. Lesbos (Mitylene): Mt. Olympus, 1886.

VI.—MISCELLANEOUS NOTES.

Sir William MacGregor.—Best known for his remarkably successful administrative work under the Colonial Office, the Right Hon. Sir William MacGregor, G.C.M.G., whose death took place in Aberdeen on July 3, was distinguished in several ways, and will be remembered not only as a great Governor, but as a medical man, an explorer, and a collector of natural history objects. In the last-named capacity and as the donor of collections made under his direction he became known to Kew about 30 years ago, when specimens of several plants used as foods, etc., in British New Guinea, of which Sir William MacGregor was the first Lieutenant-Governor, were received from him through Sir F. von Mueller, to whom he had previously sent a collection of interesting plants from the New Guinea highlands; of the latter many were new and were described by Mueller in the Transactions of the Royal Society of Victoria, vol. i. pt. 2, pp. 1-45 (1889). Larger collections from New Guinea and the Louisiade Archipelago were received direct from Sir William in 1889-90 and in 1897 and 1899. These included numerous specimens, in many instances of new species, collected on Mount

Scratchley, and on the Wharton Range and in the Vanapa Valley, New Guinea, by A. Giulianetti and A. E. English, of which an account was given in the *Kew Bulletin*, 1899, p. 95. In 1901 and 1902, while Governor of Lagos, Sir William MacGregor contributed three collections to the Herbarium, including 382 specimens collected by T. B. Dawodu. In 1904 he was transferred to Newfoundland, where he remained till 1909, and during this period he personally conducted a scientific expedition to Labrador, the object of which was to fix the longitude of some of the principal points on the coast, to make astronomical, meteorological, hydrographic, and mineralogical investigations, and to collect botanical and zoological specimens. The expedition was a great success. With the assistance of others, and particularly of the Rev. P. Hettasch, of the Moravian Mission, collections of nearly 400 specimens were made and sent to Kew. Enumerations of these were published in the *Kew Bulletin*, 1907, pp. 76–88, and 1908, pp. 135–137. Sir William's last contribution to the Herbarium was a small collection made in Grant Land by Capt. Bartlett, received in May, 1910. His services to botany are commemorated in the names of species of *Hypericum*, *Rubus*, *Gentiana*, *Cyathea*, *Daltonia*, *Ectropothecium* and *Schlotheimia*, the last three being genera of Mosses.

We learn from the interesting notice, with portrait, published in the Aberdeen Grammar School Magazine for October, that Sir William MacGregor was born at Towie, Upper Donside, October 20, 1846, so that at the close of his eventful and extraordinarily useful life he was 72 years of age. Lady MacGregor survived him only a few months, her death having occurred suddenly on December 4. S. A. S.

Prof. J. W. H. Trail.—The following list of papers, published by the late Prof. J. W. H. Trail, is a supplement to the list already printed in *K.B.*, 1919, p. 381:—

PUBLICATIONS OF PROFESSOR TRAIL.

Supplementary List.

The modes of dispersion of the seeds of Scottish wild plants. Perths. Soc. Sci. Proc. 1881–86, pp. 57–63.

The modes of dispersion of the seeds of Scottish wild plants. Scot. Nat. 1881–82, p. 257.

On the occurrence of Monoecious plants of *Mercurialis perennis*. Scot. Nat. 1883–84, p. 96.

On *Doassansia Alismatis*, Cornu, *Entyloma canescens*, Shrot, and *E. Calendulae*, Oud. Scot. Nat. 1883–84, p. 180.

Report on fungi. E. Scot. Union Rpt. 1, p. 55.

Report on plants as subjects or causes of disease. E. Scot. Union Rpt. 1, p. 66.

Report on the fungi of the east of Scotland. E. Scot. Union Proc. 2, p. 32.

Presidential address on the work of the Union. E. Scot. Union Proc. 1886, p. 13.

Report for 1886 on fungi of east of Scotland. E. Scot. Union Proc. 1886, p. 69.

Report for 1888 on fungi of east of Scotland. Scot. Nat. 1887–88, pp. 355–357.

Report for 1887 on the fungi of the east of Scotland. E. Scot. Union Proc. 1888, p. 27.

Unconscious influence of human agency on the flora of Scotland. Gard. Chron. 1889, ser. 3, vol. vi, p. 103.

Report for 1888 on the fungi of the east of Scotland. E. Scot. Union Proc. 1889, p. 37.

The gall-making Diptera of Scotland. E. Scot. Union Proc. 1889, p. 41.

Report for 1889 on the fungi of the east of Scotland. E. Scot. Union Proc. 1890, p. 49.

The work of the British Association in 1889 in relation to Scottish Scientific Societies. E. Scot. Union Proc. 1890, p. 68.

The British Association in its relation to local natural history museums. E. Scot. Union Proc. 1891, p. 21.

Report for 1890 on the fungi of the east of Scotland. E. Scot. Union Proc. 1891, p. 39.

Spiders, with a list of Perthshire species. Perths. Soc. Nat. Sci. Trans. & Proc. 1, 1891, p. 207.

Additions to the Flora of Scotland. Inverness Sci. Soc. Trans. iii, 1893, p. 408.

First records of Scottish plants. Ann. Scot. Nat. Hist. 1894, pp. 122–123.

Botanical Notes from Murthly. Perths. Soc. Nat. Sci. Trans. & Proc. ii, 1895, pp. 127–131.

Notes on the Flora of Buchan. Trans. Buchan Field Club, v, 1900, pp. 174–179.

Aliens. Trans. Aberdeen Working Men's Nat. Hist. & Sci. Soc. 1901–06, pp. 203–206.

Additions to Gardens.—Railway and transport difficulties last year continued to interfere with the interchange of material between Kew and other establishments. The total number of separate consignments, large and small, to the Gardens was exactly 300, the more important being the following:—

Edinburgh, Royal Botanic Garden.—Chinese Rhododendrons, *Meconopsis*, 350 packets of seeds collected by Forrest in Yunnan and Szechuan; *Gentiana hexaphylla*.

Singapore Botanic Garden.—3 Wardian cases of Orchids and other plants; various seeds.

Calcutta, Royal Botanic Garden.—370 packets of Himalayan seeds.

Arnold Arboretum (Prof. Sargent).—Various seeds and seedlings of trees and shrubs, including *Cunninghamia Konishii*.

Loanda Botanic Garden, Angola.—Various seeds, including *Trichoscypha* sp., "a distinct and ornamental palm," from Portuguese Congo, Raphia sp. and *Enneapogon mollis*.

Washington, Department of Agriculture.—Various plants and seeds, including new species of *Cactaceae*.

Somaliland, British (the Secretariat).—Seeds of "Yebb," *Cordeauxia edulis*, for distribution.

Melbourne Botanic Garden.—Bulbs of hybrid Watsonias.

Hong Kong Botanic Garden.—Seeds of *Paulownia Fortunei*.

Royal Horticultural Society.—Seeds of *Stevia Rebaudiana*.

Trinidad, Royal Botanic Garden. — Wardian case of plants, *Hibiscus* hybrids.

Pretoria Botanical Department (Dr. I. B. Pole-Evans).—Seeds and plants of new or rare succulents, including *Pachypodium Sealii*, *Commiphora* sp. and *Trichocaulon cactiforme*.

Khartoum Palace Garden (F. Sillitoe).—Seeds and bulbs.

Virgin Islands Experimental Station.—Seeds of *Thrinax Morrisii*, *Mamillaria nivosa*; Yams, etc.

Zionist Commission, Palestine.—Various bulbs and corms.

Dehra Dun, Forest Research Institute (B. B. Osmaston).—Seeds of *Strobilanthes atropurpureus* and *S. Wallichii*.

Glasnevin Royal Botanic Garden.—Various plants and seeds.

Liverpool Botanic Garden.—Various stove plants and orchids.

Mr. G. W. E. Loder, Wakehurst Place.—Various trees and shrubs, 150 packets of Chinese seeds, *Hanasbusaya asiatica*.

Mr. E. H. Wilson, Korea.—Seeds, *Taiwania cryptomeriodes*, from Formosa.

Mr. J. C. Williams, Caerhays Castle.—Many packets of Chinese seeds.

Mr. S. Morris, Norwich.—Collection of seedling Montbretias.

Hon. Vicary Gibbs, Aldenham.—Plants and cuttings of trees and shrubs, including *Castanopsis hystrix*.

Sir Arthur Hort, Bt., Harrow.—Seeds of Chinese Primulas.

Mr. H. A. Moore, Saintfield.—Six *Rhododendron callimorphum*, *Picea morindoides*, etc.

Mr. H. J. Elwes, Colesborne.—55 packets of Chinese seeds.

Lady Hanbury, La Mortola.—Collection of seeds, including *Jubaea spectabilis*.

Mr. C. H. Percival, Morpeth.—*Habenari-orchis viridimaculata*.

Mr. J. Hudson, Gunnersbury.—*Amaryllis Parkeri* × *Crinum*, and *Amaryllis Parkeri* × *Clivia*.

Mr. E. D. Sturtevant, California.—*Beaumontia fragrans*.

Mr. O. N. Badewell, Streatham.—Collection of seeds from Yemen, Arabia.

Dr. A. Henry, Dublin.—Seeds, *Glyptostrobus heterophyllus*.

Lady Pentland, Hereford Square.—*Lilium neilgherrense*.

Sir Alex. Hosie, Sandown.—Seeds of *Pinus Armandii* from Yunnan.

Messrs. F. Sander and Sons, St. Albans.—"Xerophytes from the mountains in Central Madagascar"—? *Pachypodium* sp.

Mr. A. Gosling, Paraguay.—Seeds of *Stevia Rebaudiana*.

Mr. G. W. Parsons, Basingstoke.—*Arundinaria tessellata*.

Messrs. Boustead and Co., Leadenhall Street.—Seeds from Brazil.

Mr. E. Frosio, Uruguay.—Seeds of *Pouteria Frosiana*.

Major L. de Rothschild, St. Swithin's Lane.—Collections of seeds from China.

Mr. C. H. Lankester, Costa Rica.—Orchids and Bromeliads.

Mr. R. M. Parker, Conservator of Forests, Chamba State.—Seeds, *Astragalus sukiensis, Ulmus Wallichiana, Morus serrata.*

Sir George Holford, Westonbirt.—Hybrid Cymbidiums.

Hon. N. C. Rothschild, Oundle.—Orchids from New Guinea.

Mr. E. Brown, Uganda.—*Pancratium trianthum,* various Orchids.

Mr. A. K. Bulley, Neston.—Seeds of *Nomocharis pardanthina.*

Mr. R. O. Williams, Trinidad.—Twelve Orchids from Trinidad, 17 packets of Palm seeds.

Mr. W. R. Dykes, Godalming.—Collection of Irises.

Mr. G. B. Michell, Perak.—Plants and seeds of 6 species of *Passiflora.*

Colonel S. R. Clarke, Cuckfield.—Seeds, *Juniperus procera.*

Mr. F. Fyles, Ottawa.—Seeds, *Zizania aquatica.*

Professor J. H. Wilson, St. Andrews.—Hybrid Passifloras.

Mr. R. Farrer.—Seeds from Upper Burma, including *Meconopsis* and *Cremanthodium.*

Sir Herbert Maxwell, Bt., Monreith.—Seeds of Iris from Tibet, and of a white Martagon lily.

Mrs. E. C. Villiars, Bexhill.—*Anaectochilus regalis* from Ceylon.

Sir Norman Lamont, Bt., Toward.—*Rosa saturata.*

Sir Edmund Loder, Bt., Leonardslee.—Various trees, including *Platanus hispanica.*

Sir John Ross of Bladensburg, Rostrevor.—Various shrubs.

Professor Gaudron, Ecuador.—*Salanum immita* and *S. Maglia.*

Major F. C. Stern, Goring-by-Sea.—*Lilium Farreri, Populus canescens* and *P. lasiocarpa.*

Donard Nursery Company, Newcastle, co. Down.—Various trees and shrubs.

Marquis of Headfort, Meath.—Various trees and shrubs.

Mr. A. Hislop, Rhodesia.—Various native plants.

Mr. R. H. Beamish, Ashbourne.—*Corylus tibetica.*

Messrs. Houghton and Co., Eastcheap.—Bulbs, *Urginea maritima.*

Corporal E. C. Phillips, Union Defence Forces.—Seeds of *Welwitschia mirabilis* and *Caralluma* sp.

Mr. J. S. Gamble, East Liss.—Seeds of *Dendrocalamus longispathus.*

Mr. M. T. Dawe, Bogotá, Colombia.—Seeds of numerous rare and interesting plants, including *Arecastrum* sp., *Quercus tolimensis, Arracacha esculenta* and Befarias.

Surplus plants were distributed as usual, either in exchange with botanic gardens or as gifts to various teaching institutions, and there was the usual distribution of seeds saved from the cultivated plants. The total number of packets distributed was 1833 of trees and shrubs, and 1151 of hardy herbaceous plants. The most important of the seeds obtained for special distribution were—Yebb (*Cordeauxia edulis*), *Ceratotheca sesamoides, Stevia Rebaudiana, Pouteria Frosiana, Rhopalostylis sapida, Bambusa arundinacea,* and *Pinus Armandii.*

Among the recipients of plants from Kew were the following:—

Weybridge Laboratory—489 trees and shrubs.

Mr. P. D. Williams, Lanarth—50 Eucalyptus Gunnii and other trees.

Mr. H. Clinton Baker, Oaklands.—Trees and shrubs.

Mr. A. Grove, Alder River Nursery.—Acers.

Lady Stair, Castle Kennedy.—Rhododendrons.

Mr. H. A. Moore, co. Down.—Chinese Rhododendrons.

Hon. Vicary Gibbs, Aldenham.—225 trees and shrubs.

Marquis of Headfort, Kells. Trees and shrubs.

Mr. F. R. S. Balfour, Dawyck.—Trees and shrubs.

Sir Hesketh Bell, Mauritius.—Wardian case of ornamental plants.

The flower beds and borders, which owing to the need created by the war had been devoted to the cultivation of vegetables, were restored to their former use. The parterre in front of the Palm House was sown with grass seeds in spring, and in the autumn the flower beds were cut out on a plan slightly different from the previous one. Potatoes were grown again on the lawn in front of the Palace, and vegetables in the nursery near the Palace.

Arboretum.—One of the most noticeable results produced in the Arboretum by the conditions of the last five years has been the overcrowding of shrubs in the botanical collections. The occupants of an ordinary shrubbery may be allowed to become fairly crowded without greatly reducing its use and effectiveness, especially where the system of grouping together plants of each species or variety is adopted, but in the botanical arrangements it is very desirable that each plant should have room for its full individual development, so that its character and value are shown. A thorough and systematic overhauling of many of the collections has, therefore, become necessary and a beginning was made last autumn with the barberries and magnolias. The central mound in the Berberis Dell is occupied almost wholly by barberries. These have been thinned out, duplicates removed and a grass path made over the mound so that plants in the centre can now be easily examined by visitors. Owing to the numerous new species introduced from China the collection is now a very extensive and interesting one, and of great horticultural value.

The plants in the fine collection of magnolias adjoining, which give one of the most popular displays at Kew every spring, were also suffering from want of room to develop. By the removal of a few common trees close by space has been obtained to enable us to spread out the magnolias. This genus has had some very interesting additions made to it through Mr. Wilson's work in China. Of these *M. officinalis*, *M. Wilsonii* and *M. Sargentiana* have for some time been established at Kew, and *M. Dawsoniana* and *M. Nicholsoniana* have recently been obtained. Another interesting specimen is a healthy plant of the Himalayan *M. Campbellii*, 18 ft. high, raised from seed sent from Calcutta in 1904. This species is usually considered to be not very hardy, but this tree has not suffered from cold up to the present. The

elegant *M. salicifolia* from Japan now flowers very freely every spring. *M. Wilsonii* flowered for the first time at Kew last summer; it is allied to, and seems to be as beautiful as, *M. parviflora*, and like that species flowers on the leafy shoots of the current year.

In the Berberis Dell is also situated the collection of *Helianthemum* and *Cistus*, which grow on a slope on the northern side. This slope has been transformed into small terraces by the use of some yellow limestone originally obtained from Gloucestershire for the Rock Garden.

The erection of the new flagstaff (see *K.B.*, 1919, p. 393), involved a certain amount of alteration and renovation in the immediate neighbourhood, but thanks to the care exercised by the contractors not so much as might have been anticipated.

The Water-lily pond in the Arboretum (J 5 on the Key Plan), formed originally in 1896, had become overshadowed and its area contracted by the vegetation overhanging its banks, much of which was composed of common laurel and other uninteresting material. Last spring much of this was removed and replaced by more ornamental and interesting plants. The occasion was also taken to provide swampy recesses on the banks for such water-loving plants as Siberian iris and *Primula japonica*.

Most of the lawns that during the war had been left to grow for hay have been got back to their original condition. This and the drought during the early summer reduced the hay crop much below that of previous years. The $2\frac{1}{4}$ acres of lawn in front of Kew Palace, ploughed up in 1918, were again planted with potatoes, the varieties used being "Majestic," "Ally," and "Kerr's Pink," all of which are immune from the dreaded wart disease. Good crops were obtained, and the potatoes of eating size were readily disposed of in the neighbourhood, whilst the "seed" was purchased by the Government of Luxemburg.

Valuable contributions either in the shape of seeds or of small plants of trees and shrubs were received during 1919 from the Botanic Gardens of Edinburgh and Calcutta, the Arnold Arboretum, Messrs. Eley, Elwes, G. W. E. Loder, Lionel de Rothschild, and J. C. Williams, the Marquis of Headfort, Sir Edmund G. Loder, and the Hon. Vicary Gibbs, the most important being seeds collected in China by Forrest and by Wilson in Japan and Korea. To the trade firms of Messrs. Hillier of Winchester, Chenault of Orleans, and White of Sunningdale, Kew has also to express its obligations for valued contributions.

Museums.—It is satisfactory to record that during the past year the work of the department has progressed more on normal lines as the Temporary Preparer and remaining Museum Porter returned from war service and much-needed work on the collections could therefore be accelerated. After a long period of service Mr. G. Badderly retired from the position of Preparer (*K.B.*, 1919, p. 315), and has been succeeded by Mr. L. J. Harding, who has acted for several years past as Temporary Preparer.

The donations to the Museums have not been numerous, but some interesting and valuable additions have been made to the collections. The work of checking and relabelling the specimens in Museum No. I is nearing completion, and it is much to be desired that at no distant date the interior of the building may be redecorated.

The Museum Staff has been busily engaged in naming and reporting upon a large number of varied economic products and in furnishing general information to correspondents, casual callers, and to the many individuals who have systematically studied the collections.

The Guide which has been prepared for Museum No. IV. has just been published.

Museum No. IV. is at the northern end of a walled garden to the left of, and three minutes' walk from the Main Gate, and two minutes' walk from the northern end of the Rock Garden. It occupies Cambridge Cottage, formerly the residence of H.R.H. the Duke of Cambridge and was opened to the public in 1910 (*K.B.* 1911, p. 69).

The object of the Museum is to direct attention to British Forestry, and in most instances the specimens on view have been grown, manufactured or collected in the British Isles. Where, however, a comparison between articles produced in Britain and other articles of a similar character produced elsewhere has been thought desirable, they have been included. A great deal still remains to be done to make the collections complete, but as numerous inquiries have been made regarding a guide, a provisional one has been prepared which will be added to as the collections increase.

Many of the objects connected with forestry operations are difficult to reproduce on a small scale in a museum, and at present the scope of this museum has been limited to collections of timber, fruits and seeds of trees, dried specimens of a few types of hardy trees and shrubs, photographs of isolated trees, plantations and natural regeneration of trees, the fungus and insect diseases of trees, articles manufactured from British-grown timber, and tools and machinery used in sylvicultural and arboricultural operations.

Presentations to Museums.—The following miscellaneous specimens have been received in addition to those previously recorded in the *Bulletin*:—

Director, Botanic Gardens, Singapore.—Woods of *Araucaria Bidwillii, Eugenia simulans, Pithecolobium lobatum, Ardisia quinquegona*, etc.

Secretary, Royal Horticultural Society.—Dried specimens of Caa-ehé (*Stevia Rebaudiana*), Paraguay.

Miss Little, Colville Terrace, London, W.—Two straw hats, two bamboo baskets, and some miscellaneous fruits and seeds from Szechuan, China.

Mr. F. G. Clark, Manchuria Road, London, S.W.—Woods of Cedar (*Juniperus procera*), Ironwood (*Olea Hochstetteri*), and Red Stinkwood (*Pygeum africanum*) from British East Africa.

Mr. F. O. Creed, East Croydon.—Sample of wax from stem of *Ceroxylon andicola* from Tolima, Colombia.

Miss Yeo, East Dean, near Eastbourne.—Cones of *Cedrus Libani* from Mount Lebanon.

Mr. J. S. Gamble, C.I.E., F.R.S., East Liss, Hants.—Sections of Beech and Hazel injured by Honeysuckle.

Director of Agriculture, Southern Provinces, Nigeria.—Fibre, yarn and "Ufa" cloth prepared from the bark of *Conopharyngia pachysiphon*, also samples of twine prepared at Old Calabar from the fibres of *Agave americana*, *Agave rigida*, var. *sisalana* and *Hibiscus vitifolius*.

Mrs. Trelawney Adams, Beaconsfield, Kew Green.—Native dress of Hibiscus fibre, ornamented with ferns, from the Tonga Islands.

Messrs. Humphreys, Percival Ellis and Co., London, S.E.—Samples of Tanning bark and Tanning Extracts.

The Right Hon. Sir H. E. Maxwell, Bart., Monreith, Wigtownshire.—Wood of *Cotoneaster frigida*, grown at Monreith. Age of tree about 40 years.

Mr. M. T. Dawe, Bogotá.—Sample of "Bogotá Tea" (*Symplocos alstonia*), wood of *Haematoxylon Brasiletto*, specimens of Cinchona barks, etc.

Conservator of Forests, Bangkok, Siam.—Thirty-two specimens of Siamese woods. J. M. H.

Research in Jodrell Laboratory in 1919.—Mr. L. A. Boodle experimented in methods of examination of plant-fibres, and made some observations on anatomical structure in *Cyclamen* and other plants.

Mr. J. C. T. Uphof studied the anatomy of some xerophytic species of *Selaginella*, and also the structure and morphology of the rhizophore in this genus.

Mr. W. C. Worsdell carried out some further work on the vascular anatomy of the Dicotyledons, especially in connection with the occurrence of medullary bundles.

Presentations to the Library during 1919.—The continuation of the several periodicals and serials received in exchange for *Hooker's Icones Plantarum*, excepting those published in Germany and Austria, have been presented as in former years by the Bentham Trustees. It is hoped that the exchanges which have been interrupted by the war will soon be resumed, and that the sets at present imperfect will be completed.

Though the additions by presentation have been very numerous and are of great value in augmenting the efficiency of the library department at Kew, there are few publications among those received in 1919 which are more than ordinarily interesting, and therefore claim especial notice.

From many agricultural, botanical or other scientific establishments in Europe, the British Colonies, India, Netherlands India, and America liberal contributions of literature of

considerable usefulness have been sent. These include the publications of the Wellcome Chemical Research Laboratories, London, from the Director; twenty-five papers on Plant Pathology, from the Director, Station of Vegetable Pathology, Paris; *Mededeelingen van de Landbouwhoogeschool*, Wageningen, from Professor J. Ritzema Bos; *The Verbenaceae of the Malayan Archipelago*, etc., by H. J. Lam, and *Bijdrage tot de Kennis der Combretaceeën en Flacourtiaceeën van Nederlandsch-Indië*, by D. F. van Slooten, and other papers, from the Director, Botanic Garden, University of Utrecht; *Prinzipienfragen der Vegetationsforschung*, by H. Gams, from Professor Hans Schinz, Director, Botanic Garden, Zurich; *Anuari* and *Musei Barcinonensis Scientiarum Naturalium Opera*, from the Junta de Ciencies Naturals de Barcelona; numerous Memoirs and Bulletins of the Agricultural Research Institute, Pusa; the Indian Forest Records and other Government publications; *A Forest Flora for the Punjab with Hazara and Delhi*, by R. N. Parker, from the Conservator of Forests, Eastern Circle, Punjab; *The preparation and vulcanisation of plantation Para Rubber*, by B. J. Eaton and others, from the Director, Department of Agriculture, Federated Malay States; a considerable number of publications issued by the Department of Agriculture, Industry and Commerce, Netherlands India, including *De Nuttige Planten van Nederlandsch-Indië*, Dl. ii-iv., by K. Heyne, *Malayan Ferns and Fern Allies*, by Capt. C. R. W. K. van Alderwerelt van Rosenburgh, supplement 1, and *Mikrographie der Holzes*, by H. H. Janssonius, 5th part, from the Director; *Mededeelingen van het Algemeen Proefstation Avros*, Medan, Sumatra, from the Director; Bulletins and other publications of the Union of South Africa Department of Agriculture, from the Director of the Department and from Dr. Pole Evans, Chief of the Division of Botany; *Waipoua Kauri Forest: its demarcation and management*, by D. E. Hutchins, from the Commissioner of State Forests, New Zealand; selected publications of the United States Department of Agriculture, from the Secretary; *Journal of the Arnold Arboretum*, 2 numbers, and the continuation of the *Bulletin of Popular Information*, issued by the same establishment, from the Director, Prof. C. S. Sargent; the continuation of *Rhodora* and further *Contributions from the Gray Herbarium of Harvard University*, including a bound copy of vol. ii., from Prof. B. L. Robinson; the 3 parts published during the year of the *North American Flora*, from the Director of the New York Botanical Garden; numerous papers and bulletins on Plant Diseases from the Departments of Plant Pathology of Cornell and Purdue Universities' Agricultural Experiment Stations; Report for 1917–18 of the Agricultural Experiment Station, Santiago de las Vegas, Cuba, from the Director; and *Fibras texteis e cellulose*, by M. Pio Corrêa, from the Ministry of Agriculture, Rio de Janeiro.

The Secretary of State for India has presented a copy of *Indian Medicinal Plants*, by Lieut.-Col. K. R. Kirtikar and Major B. D. Basu. This work, which was published by the Panini Office,

Allahabad, comprises 2 quarto volumes of text and 1033 uncoloured plates. The latter are mostly copied from the well-known but often rare and not easily accessible works of Roxburgh, Wallich, Wight, Griffith, Brandis and others. From the same source has been received a *Report on an inquiry into the Silk Industry in India, 1916*, by H. Maxwell-Lefroy and E. C. Ansorge, in 3 thin folio volumes, and the third part of the *Flora of the Presidency of Madras* by J. S. Gamble, a copy of which has also been presented by the author.

Prof. F. O. Bower has sent a complete set in 7 parts of his *Studies in the Phylogeny of the Filicales*, which appeared in the *Annals of Botany*, 1910–18. Two copies of Prof. Bower's excellent little work on Sir J. D. Hooker, published by the S.P.C.K., have been received from the publishers.

The Trustees of the Bernice Pauahi Bishop Museum, Honolulu, have published a handsome volume on the Lobelioideae of the Hawaiian Islands, by J. F. C. Rock, and have kindly presented a copy to the library.

Mr. J. H. Maiden has issued during the year parts 36 to 38 of his *Critical Revision of the Genus Eucalyptus*, and Kew is indebted to him for these as well as for the parts received in previous years.

In 1889 Dr. L. H. Bailey commenced a series of volumes entitled *Annals of Horticulture in North America*, of which five volumes have been published, covering the years 1889 to 1893. Only one—that for 1890—was at Kew till a few weeks ago, when Dr. Bailey sent the volumes for 1889, 1892 and 1893. The 1891 volume, still wanting, has been out of print for a long time. A copy of *Bush Fruits*, by F. W. Card, has also been presented by Dr. Bailey.

Among the larger works received as presentations from their authors should be mentioned the following:—*Les Astérinées*, by G. Arnaud; *Etude anatomique de la famille des Ternstroemiacées*, by L. Beauvisage; *Science and Fruit Growing*, by the Duke of Bedford and S. Pickering; *El Jardin Botanico del Instituto de Segunda Enseñanza de la Habana*, by F. G. Cañizares; *The Marine Biological Station at Port Erin*, by W. A. Herdman; *Etude . . . des Chlaenacées*, by F. Gérard; *A Monograph of the Norwegian Physciaceae*, by B. Lynge; *Nature and uses of Madras Timbers*, by A. W. Lushington; *The Origin and Development of the Compositae*, a reprint of a series of articles in the *New Phytologist*, by J. Small.

The following have also been received:—*Flora y Fauna* and *Climatologia de la Provincia de Santiago del Estero* [Argentine Republic], by A. Alvarez, from Sir Reginald Tower; *Upper Cretaceous Floras of the Eastern Gulf Region in Tennessee, Mississippi, Alabama and Georgia*, by E. W. Berry, from the Secretary, Ministry of Agriculture and Fisheries; *Details of specimens of Rhododendrons found by Mr. G. Forrest in 1917* and *1918*, from Mr. J. C. Williams; *Antonio Jatta, 1853-1912*, from Mr. Mauro Jatta; *The Essentials of American Timber Law*, by J. P. Kinney, and *Indentification of the Economic Woods of the United States*, by S. T. Record, from Messrs. Chapman and

Hall; *Studien über Konstruktions-typen und Entwicklungswege des Embryosackes der Angiospermen*, by B. Palm, from Prof. G. Lagerheim, who has also sent several papers by himself and others; *Hortus Bengalensis*, by W. Roxburgh, from Mr. W. Small. The last named once belonged to Dr. W. Ainslie, the author of a *Materia Medica of Hindoostan*, and bears his autograph on the title-page.

The three Botanical Memoirs published by the Oxford University Press (1, *The Building of an autotrophic Flagellate*, by A. H. Church; 2, *Gossypium in pre-Linnaean Literature*, by H. J. Denham; and 3, *Thalassiophyta and the subaerial Transmigration*, by A. H. Church) have been presented by their authors.

Other contributions to the library have been received from Dr. J. C. Arthur, who has sent his recent papers on the Uredinales, Mr. B. C. Aston, Mr. R. T. Baker, Dr. P. A. A van der Bijl, Dr. J. Briquet, Prof. G. Bitter of Bremen, Dr. F. Börgesen, Dr. Brotherus, Dr. E. J. Butler, Prof. D. H. Campbell, Miss A. Camus, Dr. A. Chevalier, Prof. T. D. A. Cockerell, Dr. E. De Wildeman, Mr. O. A. Farwell, Dr. E. Foex, Sir T. R. Fraser, Prof. P. F. Fyson, Mrs. Grieve, Dr. E. Hassler, Prof. L. Hauman, Dr. W. Kinzel of Munich, Mr. C. C. Lacaita, Mr. C. G. Lloyd, Dr. E. P. Phillips, Lieut.-Col. Sir David Prain, Prof. F. Ramaley, Mr. H. N. Ridley, Dr. J. N. Rose, Dr. C. L. Shear, Mr. W. T. Swingle, Dr. A. Wartenweiler, Mr. C. T. White, Mr. E. H. Wilson and Mr. W. F. Wilson. The titles of their contributions cannot be given in this note, but those that are not excerpts from publications at Kew will be incorporated in a forthcoming supplement to the catalogue. The excerpts are arranged according to authors' names, and are easily accessible, without the aid of the catalogue, in the large collection of tracts preserved in the library.

Presentations of periodicals include, besides the new *Journal of the Arnold Aboretum* to which reference has already been made, the first number of *The Journal of Indian Botany*, edited by Prof. Fyson and presented by him, *Bulletin of the Rubber Growers' Association*, from the Secretary, *Jahresbericht der Gesellschaft zur Förderung der naturhistorischen Erforschung des Orients in Wien*, 1896–1913 (except 1907 and 1911), from Dr. Otto Stapf, and the *Journal of Pomology*, just begun under the editorship of Mr. E. A. Bunyard, and presented by the publishers, Messrs. George Bunyard & Co., Ltd.

Manuscripts that should be mentioned here are:—A collection of original letters from various botanists to Mr. J. F. Duthie, presented by Mr. Duthie; Piperaceae of the Malayan Peninsula for King & Gamble's *Materials*, by C. de Candolle, from Mr. Gamble; *Catalogue of Succulents and other Plants, cultivated in Succulent House, Royal Botanic Gardens, Kew*, 1872, by R. I. Lynch, from the author; a volume of original letters from W. Roscoe, of Liverpool, to N. Wallich, dated 1818–1830, from Mr. Leopold Cust, through the kind offices of Mr. H. N. Ridley. Numerous letters and other manuscripts relating to the *Flora of British India*, Bentham & Hooker's

Genera Plantarum, etc., have been presented by Lady Hooker, who has also kindly sent to Kew, at present as a loan, Sir J. D. Hooker's considerable and valuable botanical correspondence.

Additions to the Herbarium during 1919.—During the year about 22,000 specimens were received as donations or exchanges and 3380 acquired by purchase, while about 8000 were received on loan in addition to those temporarily deposited for the preparation of the "Flora of Madras." The principal collections are enumerated below:—

Europe.—*Presented*: Britain: Cornwall, by Mr. Edgar Thurston; Oxfordshire, by Mr. W. B. Turrill; plants cultivated by Mr. Thos. Clark at Bridgwater, by Mr. H. Stuart Thompson.

Orient.—Presented: Syria, by Lord Lamington and Miss M. L. Yeo; Palestine, Ephraim Hills, west of the Jordan Valley, by Capt. G. H. Ogilvie; Palestine, chiefly at Wady-el-Jib, by Mr. G. C. Johnson; Mesopotamia, by Capt. G. A. Watson.

Purchased:—F. Vester and Co., Palestine.

North Africa.—*Presented*: Egypt (Dr. A. Keller), by Dr. Hans Schinz; Morocco, by Professor C. J. Pitard.

China.—*Presented*: Chili Province; Peitaiho, Peking and Wofussu, by Mr. N. H. Cowdry.

India.—*Presented:* various localities, by Mr. R. S. Hole.

Malay Peninsular.—*Presented*: Pahang, etc. (Mohamed Haniff and Mohamed Nur), by Mr. I. H. Burkill; North-western coast and islands (J. H. N. Evans and C. Boden Kloss), by Mr. H. C. Robinson; various localities (H. N. Ridley), by Mr. I. H. Burkill.

Malaya.—*Presented*: Siam (Mohamed Haniff and Mohamed Nur), by Mr. I. H. Burkill; Siam, Rajburi District (Khoon Winit Wanadorn), by Mr. W. F. Lloyd; Fungi Malayana, centudies 4 and 5, by Mr. C. F. Baker; Philippine Islands (E. D. Merrill's collectors), by Prof. C. S. Sargent.

Australia.—*Presented*: South Australia, by Mr. J. M. Black; various localities, by Mr. J. H. Maiden and Dr. R. S. Rogers; Tasmania, by Miss L. S. Gibbs.

Tropical Africa.—*Presented*: Nigeria, Northern Provinces (H. V. Lely), by Mr. E. W. Foster; Sudan, Lado District (T. Cartwright and F. S. Sillitoe), by the Director of Forests, Sudan; British East Africa, highlands, by Mr. J. D. Snowden; British East Africa (members of the Forestry Department and Miss Werner), by Mr. E. Battiscombe; Uganda, by Mr. R. A. Dummer, Mr. T. D. Maitland and Mr. R. Fyffe; German East Africa, by Mr. E. Battiscombe on behalf of the Political Officer, Morogoro; Central Africa (Archdeacon W. P. Johnson), by the Rev. H. J. Riddelsdell; Rhodesia, by Mr. F. Eyles.

South Africa.—*Presented*: South-west Africa (Rautenen and Schlechter), by Dr Hans Schinz; Transvaal, by Dr. I. B. Pole-Evans; various localities, by the Bolus Herbarium.

North America.—*Presented*: Yukon (Miss Alice Eastwood) and the south-western United States (E. J. Palmer and B. F. Bush), by Prof. C. S. Sargent; British Columbia, Kelowna, by Miss E. M. Warren; and the following by the Gray Herbarium:—Plantae Exsiccatae Grayanae, centuries 2 and 3; Newfoundland and Labrador (M. L. Fernald); Quebec, Gaspé County (J. F. Collins and M. L. Fernald); Bermuda (F. S. Collins); South California (Mrs. Spencer); Texas (B. H. A. Groth); Florida (A. Fredholm).

Purchased: S. M. Zeller, Washington State; S. F. Collins, Phycotheca Boreali-Americana, fascicle 46.

Central America.—*Presented*: Mexico (Dr. E. Palmer), by Mr. F. V. Coville; Mexico and Cuba (Frères Arsène, Nicolas and Léon), by Prince Roland Bonaparte; Nicaragua (C. F. Baker), by the Gray Herbarium.

West Indies.—*Presented*: Jamaica, etc. (W. Harris, Dr. N. L. Britton and others), by the Director-in-Chief, New York Botanical Gardens; Porto Rico, by F. L. Stevens; Bahamas (A. E. Wright), by the Gray Herbarium.

South America.—*Presented*: Colombia; Ruiz, Caldas, Department del Valle and Darien Country, by Mr. M. T. Dawe; Colombia (Mr. F. W. Pennell and Dr. H. H. Rusby), by the Director-in-Chief, New York Botanical Gardens.

Purchased: Dr. E. Hassler, Paraguay; Dr. Otto Buchtien, Herbarium Bolivianum, century 5 and supplement 1.

Mr. Edgar Thurston, C.I.E., has presented the herbarium of Cornish plants collected chiefly by himself during several years residence in Cornwall. The specimens were mountel by him on sheets uniform in size with those in use at Kew and form a valuable addition to the British collections, which are not well represented by recent specimens. Seeds of British plants have been given by Mr. W. B. Turrill to supplement the seed collection now being formed in the Herbarium. From Mr. H. Stuart Thompson has been received a collection of dried specimens of plants cultivated in the early part of the last century at Bridgwater by Mr. Thomas Clark. Southern Palestine plants have been received from Capt. G. H. Ogilvie and Mr. G. C. Johnson. Lord Lamington, G.C.M.G., Commissioner to the British Relief Unit to Syria, has presented specimens collected by him and Miss M. L. Yeo in the Lebanon, Antilebanon and Beirut districts. Specimens collected in Mesopotamia by Capt. G. A. Watson have been presented through Mr. A. Sharples. Prof. C. J. Pitard, of Tours, has presented a large collection made by him chiefly in Morocco. Various critical species of Indian plants have been contributed by Mr. R. S. Hole. Malay Peninsula plants have been represented by collections made in the north-western part of the peninsula and lower Siam under the auspices of the Director of the Federated Malay States Museum, which are being worked out at Kew by Mr. H. N. Ridley, as well as those from Pahang and other localities at the instance of the Director of the Botanic Gardens, Singapore. A fine set of Philippine plants gathered by Mr. E. D. Merrill's collectors has been presented by Prof. C. S. Sargent. Khoon

Winit Wanadorn has collected in the Rajburi District of Siam, and his specimens have been received through Mr. W. F. Lloyd, Conservator of Forests. Mr. J. H. Maiden has sent various Australian plants, including new species described by him. Mr. J. M. Black has presented specimens of some of the new species published by him in the *Transactions of the Royal Society of South Australia*, and Dr. R. S. Rogers has given Australian Orchids. A continuation, comprising *Coniferae*, monocotyledons and cryptogams, of the collection made in Tasmania by Miss L. S. Gibbs, F.L.S., has been presented by her. Botanical collecting has again been active in Tropical Africa. Two collections from the Lado District (one along the Yei River) of the Sudan have been received from expeditions organised by the Director of Forests, Sudan. Mr. J. D. Snowden has explored the highlands of British East Africa and presented his collections to Kew, while other parts of that region have been visited by members of the Forestry Department. Uganda Fungi have been contributed by Mr. T. D. Maitland and Mr. R. A. Dummer. Dr. I. B. Pole-Evans, Chief, Division of Botany, Pretoria, has continued to contribute Transvaal plants, and valuable specimens have been received from the Bolus Herbarium.

The North American collections have been augmented, especially by the contributions, detailed above, from Dr. B. L. Robinson, Curator of the Gray Herbarium, Harvard University. Dr. N. L. Britton, Director-in-Chief, New York Botanical Garden, has continued to send valuable instalments of West Indian plants collected by him, Mr. W. Harris and others, as well as a collection made in the Republic of Colombia by Mr. F. W. Pennell and Dr. H. H. Rusby. Mr. M. T. Dawe has made several expeditions in the last named country and forwarded his specimens to Kew.

The collection of illustrations consists largely of representations of portions of plants and their details, but is deficient in pictures showing the habits of trees and shrubs: this has been partly remedied by a donation of photographs of West Indian and East African trees from Dr. Andrew Balfour, C.M.G., Director-in-Chief of the Wellcome Bureau of Scientific Research, and of similar photographs of trees from the Malay Peninsula and Ceylon by Mr. H. N. Ridley, C.M.G.

A collection of photographs showing the appearance of important plant diseases in the tropics is in course of formation, and contributions have been received from Mr. L. Lewton-Brain, Director of Agriculture, Federated Malay States; Dr. I. B. Pole-Evans, Pretoria; and Sir Francis Watts, K.C.M.G., Commissioner of Agriculture, Barbados, on behalf of Mr. W. Nowell.

Effect of removing the Pulp from Camphor Seed on Germination and the Subsequent Growth of the Seedlings.—A reprint of a paper by Mr. G. A. Russell, of great importance to those engaged in the camphor industry, which appeared in the United States Journal of Agricultural Research, Vol. xvii, No. 5, has been issued from the Government Printing Office, Washington.

In Florida and other countries the development of the camphor industry has been checked by the low percentage of seeds which produced transplantable seedlings, about 10 per cent. being the average, therefore during the winter of 1916–17, and again in 1917–18, experiments were undertaken by Mr. Russell to determine whether, by the adoption of any special method of seed preparation before sowing, better results could be obtained.

Previous experience indicated that the removal of the pulp from the seeds before sowing hastened, if it did not increase, germination, whilst there was a prevalent belief that the exposure of the fruits to frost whilst on the tree was detrimental to seed germination. Therefore, these were two of the chief factors borne in mind whilst conducting the experiments. In addition, the action of fermentation, dry and moist heat, and sulphuric acid on the vegetative properties of the seeds was studied. Attention was also paid to the difference in the germinating qualities of seeds picked up beneath the trees during the early ripening period and those that were hand-picked from the trees a little later.

The results of the 1916–17 experiments proved conclusively that seeds from which the pulp had been removed previous to sowing, not only germinated more quickly than unpulped seeds, but that the percentage of seedlings rose from 9·4 in the case of seeds sown as gathered from the tree to 60·1 in pulped seeds. Seeds that fell to the ground early were found to be less fertile than those that remained on the trees to a later date. Before the removal of the pulp 5·9 per cent. of such seeds germinated, 15·6 per cent. germiating after the removal of pulp.

Exposure to frost on three successive nights, the lowest temperature being 26° F., did not result in the total loss of the power of germination, although about 50 per cent, fewer seedlings appeared than from unfrozen seeds. From frozen seeds, as gathered from the tree, 4·5 per cent. germinated and, after the removal of the pulp, 32·6 per cent. A curious result was obtained by soaking frozen seeds in water at a temperature of approximately 25° C. for 18 hours, for the germinating percentage of unpulped seeds was reduced, whereas the germination of pulped seeds was increased by 23 per cent.

One thousand seeds enclosed in a jar and fermented for 35 days failed to produce a single plant, but seeds fermented for 8–10 days and then spread out to cool and dry produced the normal number of seedlings. Seeds artificially dried at a temperature of approximately 55° C. failed to germinate, and the same thing happened after seeds had been allowed to air dry in an attic for several weeks. Soaking in water at a temperature as high as 50° C. had no effect on germination, but pulped seeds treated with 5 per cent. sulphuric acid failed to germinate.

In addition to the experiments confirming the view that pulped seeds germinated more quickly than unpulped, they also indicated that the earlier germination enabled a greater percentage of seedlings to reach a transplantable size; the few weeks earlier growth enabling them to withstand the effects of hot sun during spring. Seeds sown early in winter took longer to germinate than those sown in spring, but generally they formed sturdier plants.

The 1917–18 experiments were commenced in November, 1917, and in order to ascertain whether seeds taken from different trees possessed the same germinating qualities, seeds were gathered separately from 10 trees on November 27, and they were taken from all parts of the trees, so that each sample was thoroughly representative of the yield. They were sown on November 28, part as gathered and part pulped. The percentage of germination differed in the seeds from the different trees, but in every case the pulped seeds both germinated quicker and better than the unpulped. From the 10 trees the percentage of seedlings from unpulped seeds varied from 3 to 23·4, whilst for pulped seeds the minimum was 65·2 and the maximum was 95·4. A diagram illustrating the percentage of seedlings from each kind of seed from the 10 trees is both interesting and instructive.

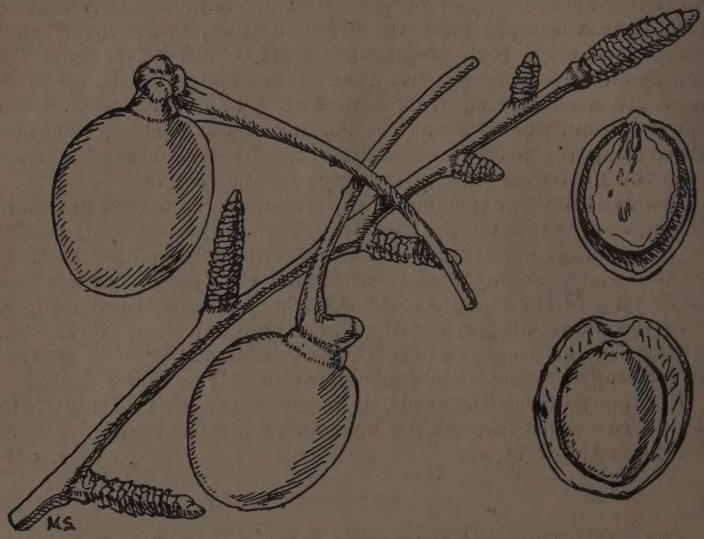
In this series of experiments the advantage of earlier germination was very pronounced. Seedlings from unpulped seeds gained on the average a fortnight's advantage, which enabled them to become well enough rooted to withstand the heat of the sun and the drying of the surface soil. At transplanting time, not only were the plants bigger, but they were better in every way. The increase in the number of seedlings of transplanting size secured by pulping the seed amounted approximately to 600 per cent.

In order to clean the seeds, it is recommended that the fruits should be rubbed through a wire screen and afterwards sun-dried for one or two days. W. D.

The Fruiting of the Ginkgo at Kew.—There does not appear to be any record of the Ginkgo having borne fruits in the British Isles. Kent, the author of Veitch's *Manual*, evidently had no knowledge of this having ever occurred, and observes merely that fruit is "rarely, if ever, seen in this country." Elwes and Henry, too, in *The Trees of Great Britain and Ireland*, p. 56, say that "no fruit so far as they know has ever been produced in England." It is worth while, therefore, to put on record the production of fruits at Kew.

Ginkgo biloba, as is well known, bears dioecious flowers; that is to say, the male and female flowers are borne on separate trees. The fine tree at Kew, the best known of all Ginkgos to the general public of this country, was planted where it now stands probably about 1760. Being then a very rare and precious plant whose hardiness had not been proved, it was planted against a wall and trained like a fruit tree. Ultimately the wall was taken down and the side branches of the Ginkgo were cut away, since when it has assumed its present fine shape and dimensions. It first bore flowers in 1795 which proved to be male. In recent years it has blossomed frequently; and sometimes so profusely as to litter the ground beneath it with its small, green, cylindrical inflorescences. It was this free production of staminate flowers which suggested that if female shoots were grafted on the tree, fruits might eventually be obtained. Accordingly application was made to Mr. Flauhault, Director of the Montpellier Botanic Garden, for grafts from the famous female tree that grows there

and each year bears fertile fruit. These he kindly sent in February, 1911, and they were duly "worked" on the tree at Kew. Some of them united satisfactorily, but nothing further was noticed until last November, when, on the leaves falling away from the branches, four fruits were seen to be hanging on one of the Montpellier grafts.



The "fruits"—bright yellow, a little over one inch long, like a small plum in shape and each borne on a stalk 1½ to 2 inches long—are not fruits in the strict botanical sense, but seeds with a thin fleshy covering. This outer layer has a most offensive odour resembling that of butyric acid, but the kernel of the seed is pure white when washed and edible. Mr. E. H. Wilson tells us that they are on sale in most of the market towns of China and Japan, also, but not so commonly, in those of Korea and Manchuria. Henry says that they are eaten roasted at feasts and weddings and are supposed "to promote digestion and diminish the effects of wine-drinking."

In regard to the sex of the Ginkgo there is a general impression that the female tree differs from the male in being less pyramidal, and in having spreading or even pendulous branches. Mr. E. H. Wilson, who has had a very large acquaintance with the Ginkgo, both in China and Japan, controverts this view in a recent number (November, 1919) of the *Garden Magazine*. He says there that he has never found it possible to determine the sex of a tree by its mode of growth and that both the Chinese and Japanese say it is impossible to do so.

A fine example of a female tree with spreading branches may be seen in the Botanic Garden, Padua (the ground below the tree was crowded with seedlings in 1918). Other fine female trees may be seen at Ouchy by the Lake of Geneva.

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